TECHNOLOGY DEPT

SEPTEMBER, 1944

POWER

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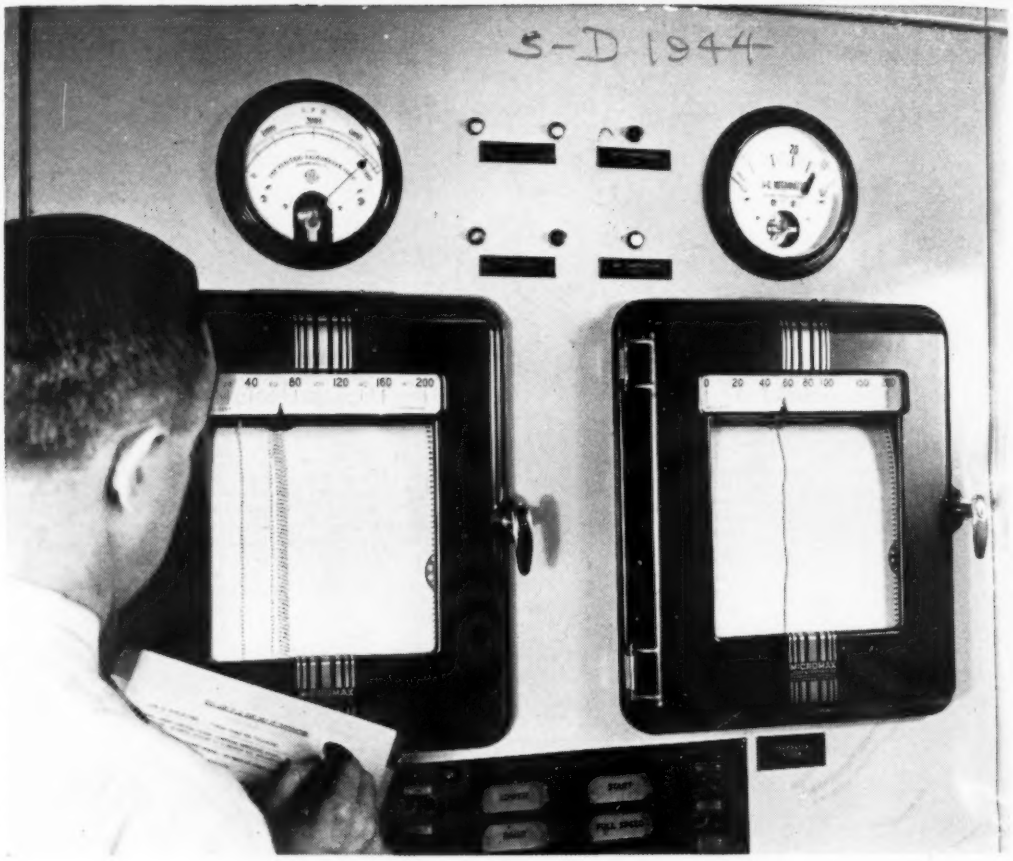
A REPORT TO ENGINEERS

POWER FOR PEACE

PAGES 63—78

S-D 1944



Micromax Recorder at left shows temperature of 6 points in stator, and also of exciter air and outlet water of the hydrogen cooler of a generator. Recorder at right shows temperature of the field. Watching these 9 temperatures is essential when carrying heavy load, though Recorders will also sound alarms if any one temperature exceeds a predetermined point.

"OVERLOADED" GENERATORS
Need This Micromax Field & Stator Protection

Loading of electrical generators on the basis of the temperatures of their stators and rotors is a practice which many power companies are now planning to use. Special tests have been outlined* to determine the amounts of load which may be added, under specific conditions, to that given as maximum on the nameplate. Here are some of the factors to be considered:

1. Each generator is a separate problem.
2. Nameplate data may provide unnecessarily large safety factor for load swings, unbalanced phases, etc.
3. Ambient temperature may be less than nameplate specifies.
4. Power factor may be higher than specified.
5. Change in terminal voltage may permit greater output.
6. When starting from low temperature, a generator can carry short-time excess load because of its own temperature lag.
7. In emergencies and for short peaks it may be more economical to operate at extraordinary temperature and thus age the insulation at an abnormal rate, rather than to provide the additional rated capacity for short-time loads.

When a generator is loaded on the basis of temperature, we can supply its operator with complete temperature readings by means of two instruments—a Micromax Stator Temperature Recorder and its companion, a Rotor Recorder.

The Stator Recorder shows the temperature of 6 points, and of incoming and outgoing cooling medium. It sounds an alarm if a peak temperature is reached.

The Rotor-Temperature Recorder measures the resistance of the entire field and records it as temperature. Devised about 15 years ago, it has been less used than the Stator Recorder, for the reason that not every generator normally needs both instruments. As load becomes abnormal, or unfavorable power factor conditions occur, however, this instrument has come increasingly into use and under present-day conditions is rapidly becoming standard equipment for large generators.

Both instruments are described in Catalog N-33-161, available on request. If you have a specific instrumentation problem in mind, please describe it and an L&N engineer will gladly try to help solve it.

* From AIEE Miscellaneous Paper 43-93, "Interim Report on Emergency Measures to Increase Output of Generating Equipment and Systems", June 1943, available at 65c from AIEE, 33 W. 39th St., New York City.

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

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MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

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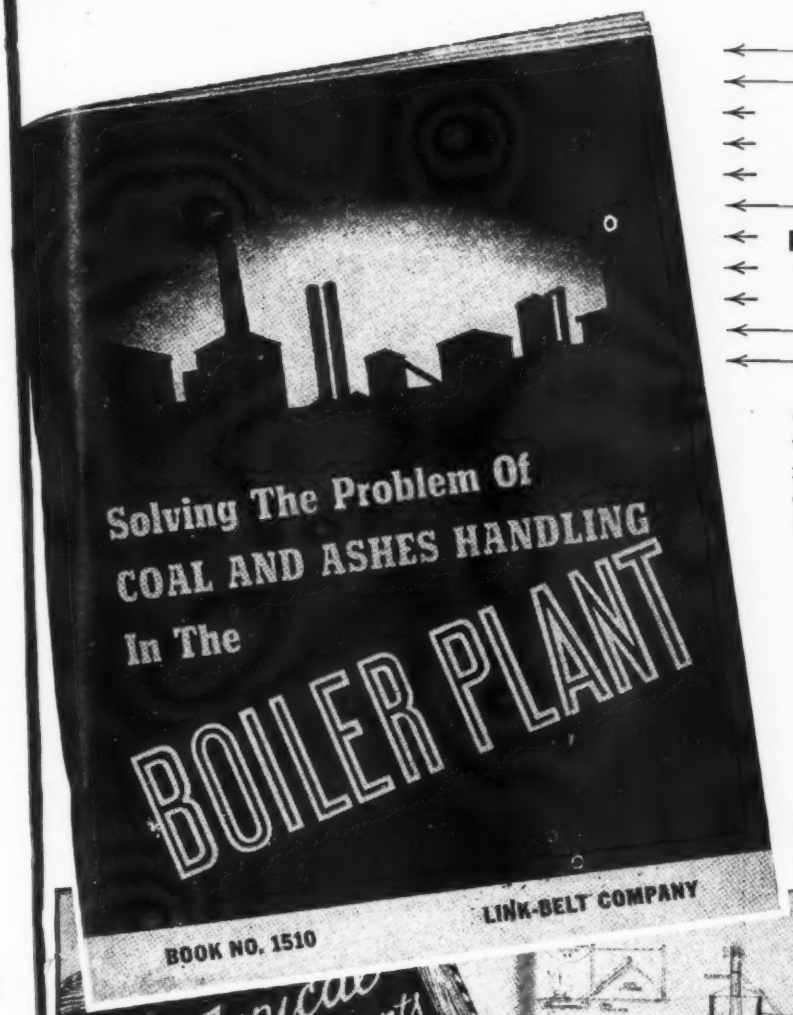
ARMY NAVY *V depends on me!*

A Slogan For Every American

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), September, 1944, Vol. 88, No. 9. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Posssessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions, 36 shillings per year. All other countries, $6.00 for one year, $9.00 for two years. Single copies 35 cents.



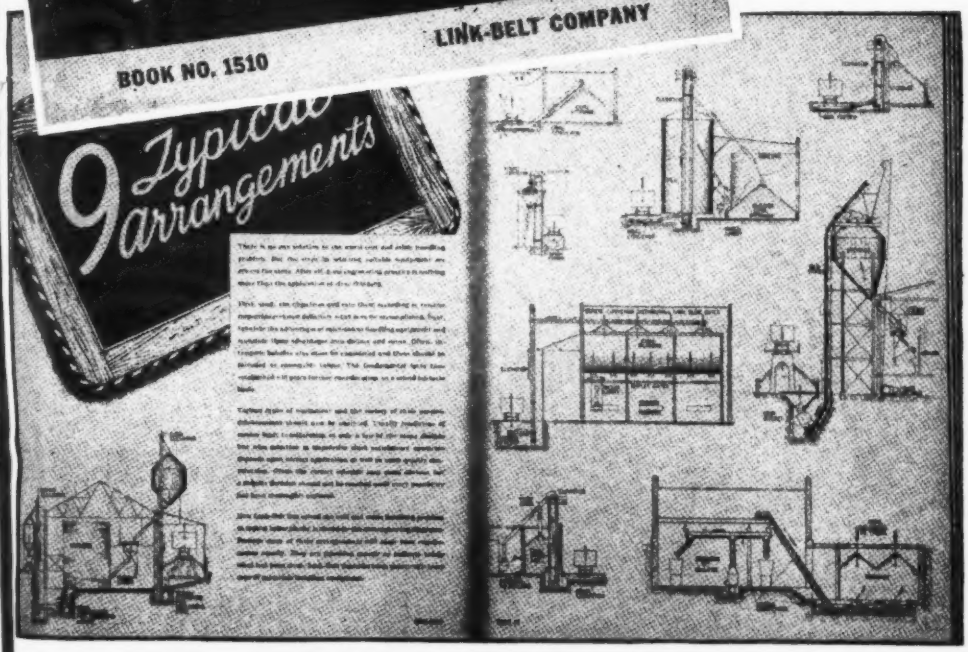
SEND FOR THIS BOOK

● A 32-page idea and suggestion book of ways and means of increasing boiler room efficiency and cutting handling costs.

Some of the subjects covered are—

Handling truck deliveries efficiently
The silo storage system
Elevators and screw conveyors
The belt conveyor
The skip hoist
Feeders and crushers
Pivoted bucket carriers
Weighing coal
Water intake screen equipment
Typical arrangements

Send for your copy today. Ask for book No. 1510.



THE LINK-BELT LINE INCLUDES:

Conveyors of all types, such as belt, bucket, screw, flight, Bulk-Flo drag chain, apron, etc.; bucket carriers and elevators; skip hoists; feeders of all types; weigh larries; locomotive and crawler type cranes; coal crushers; water intake screens; rotary railroad car dumpers and underfeed screw type stokers.

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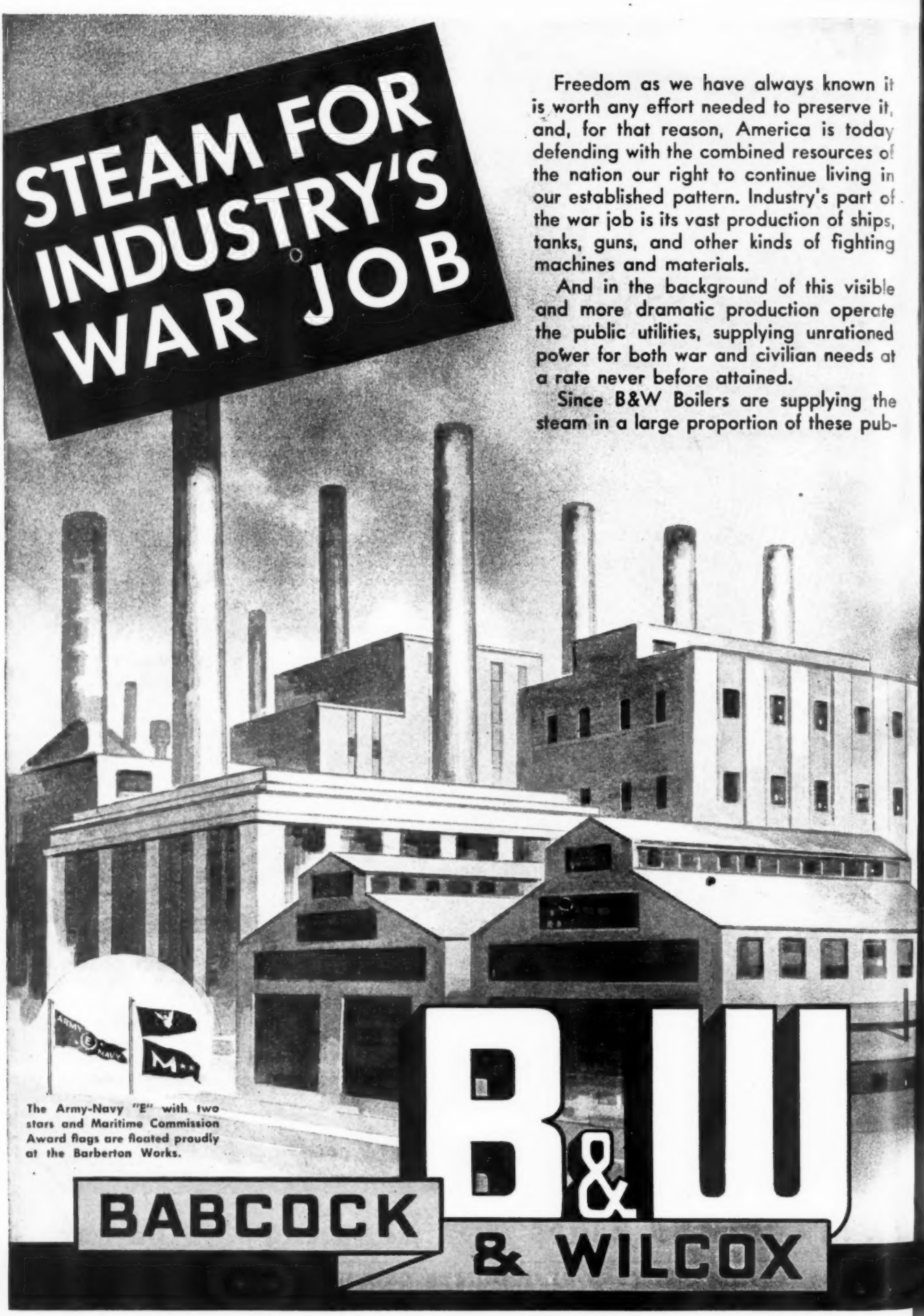
STEAM FOR INDUSTRY'S WAR JOB

Freedom as we have always known it is worth any effort needed to preserve it, and, for that reason, America is today defending with the combined resources of the nation our right to continue living in our established pattern. Industry's part of the war job is its vast production of ships, tanks, guns, and other kinds of fighting machines and materials.

And in the background of this visible and more dramatic production operate the public utilities, supplying unrationed power for both war and civilian needs at a rate never before attained.

Since B&W Boilers are supplying the steam in a large proportion of these pub-



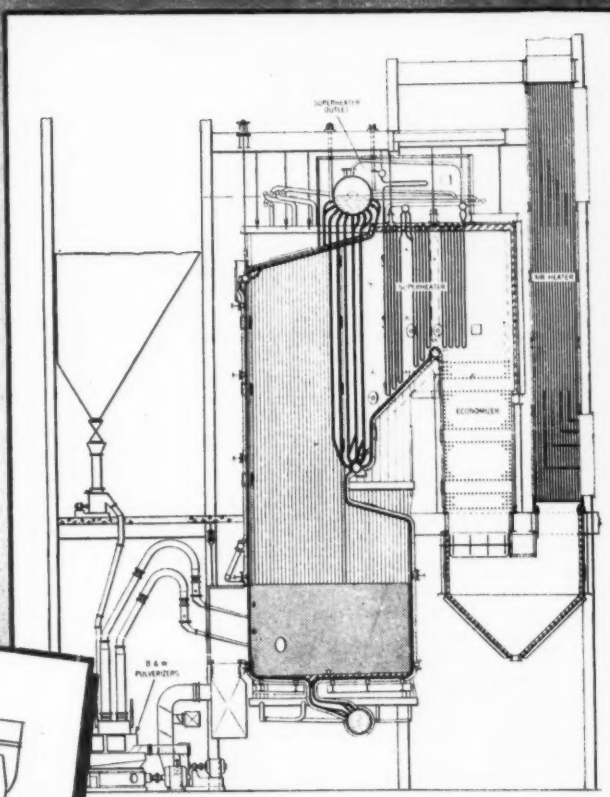
The Army-Navy "E" with two stars and Maritime Commission Award flags are floated proudly at the Barberton Works.

BABCOCK & WILCOX

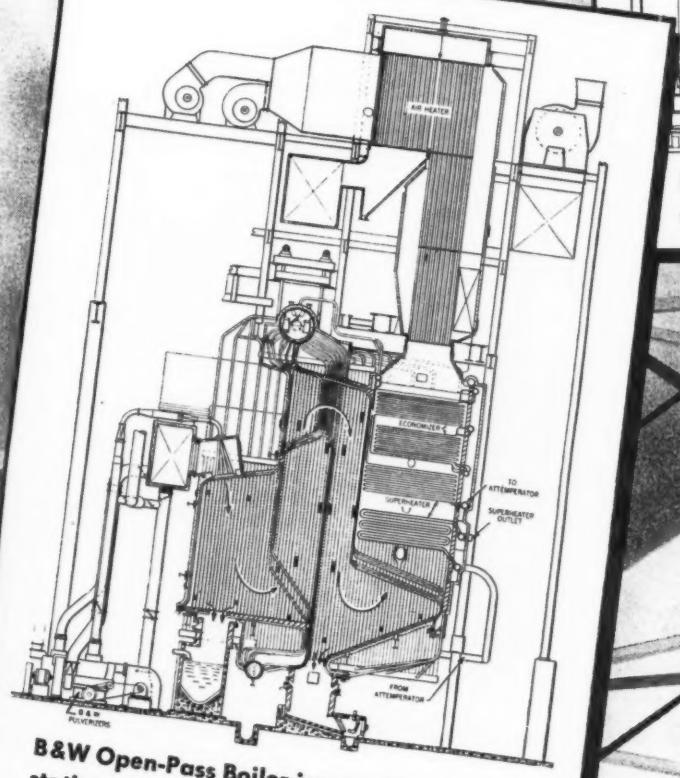
B&W

lic utility and industrial power plants, and for propelling naval and cargo ships, B&W is playing a substantial part in this great war effort. B&W engineering and production skill have built into its boilers the stamina to endure today's gruelling drive.

With today's accelerated experience yielding more complete answers to such problems as behavior of metals at high temperatures, action of fuels in slag-tap and dry-ash furnaces, circulation in high-capacity high-pressure boilers, separation of steam from water in boiler steam drums, and other related problems, the boilers of tomorrow should be even better able to serve industry.



B&W Radiant Boiler in an eastern central station—Capacity 400,000 lb. steam per hr.



B&W Open-Pass Boiler in an eastern central station—Capacity 350,000 lb. steam per hr.

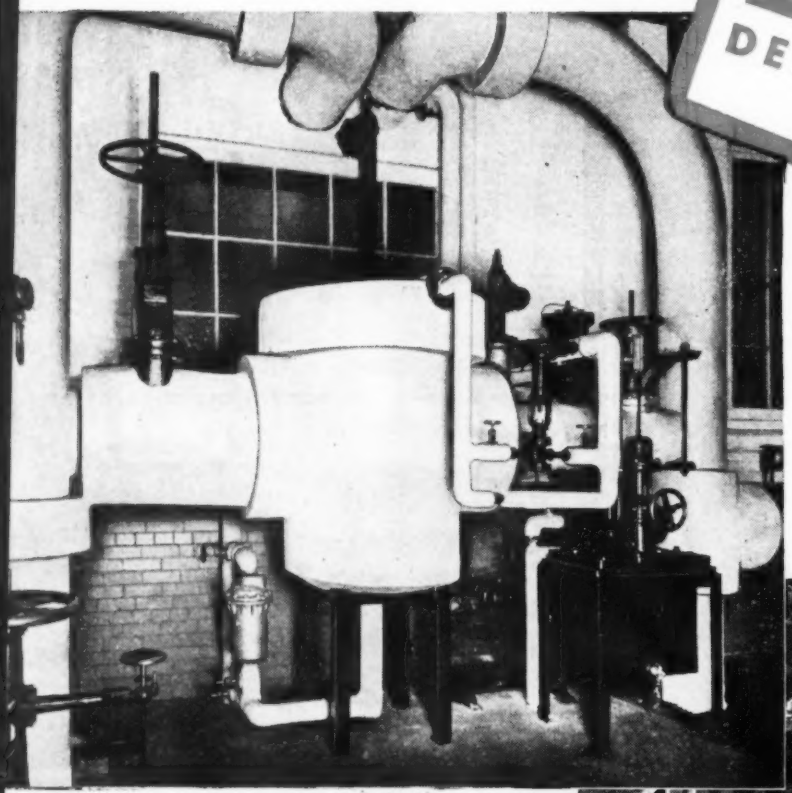
THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET NEW YORK 6, N. Y.

G-254

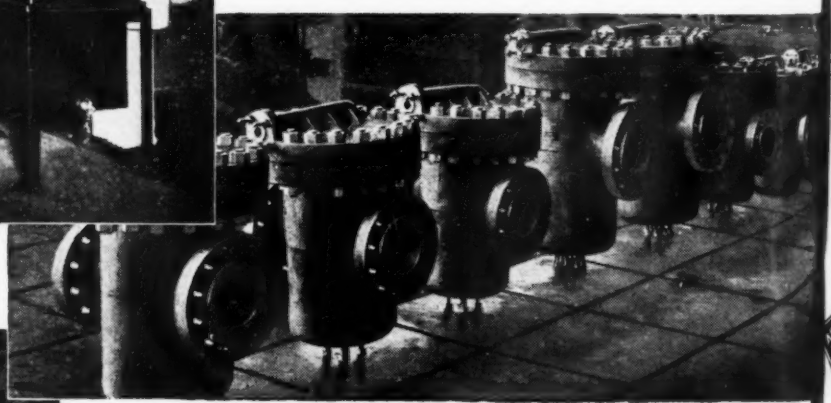
2 services vital to

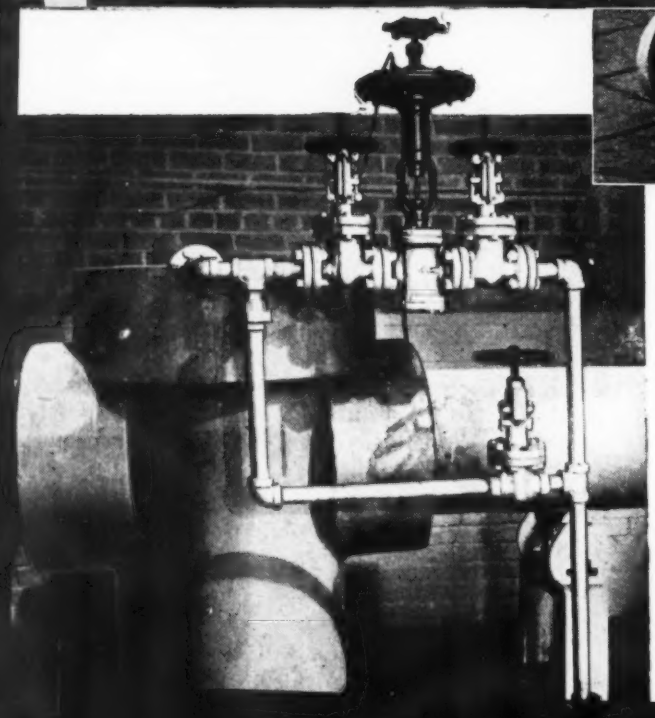
IN A TEXTILE MILL, this 20-in. Elliott cartridge type desuperheater takes superheated steam extracted from the turbine of a turbine-generator unit removes the superheat, and delivers the steam for process and for plant heating. This desuperheater is rated at 62,000 lb. of steam per hour, 30 lb. pressure, 575 deg. F. in and 335 deg. F. out. Photo shows unit complete with reducing valve, pressure regulator and temperature control.

Taking superheat out of steam . . . ELLIOTT DESUPERHEATERS



IN MARINE POWER PLANTS, these Elliott desuperheaters will serve oil tankers, reducing steam temperature in lines adjacent to highly volatile petroleum products. This reduction is from 700 to about 500 deg. F., well below flash point of the tanker's cargo.



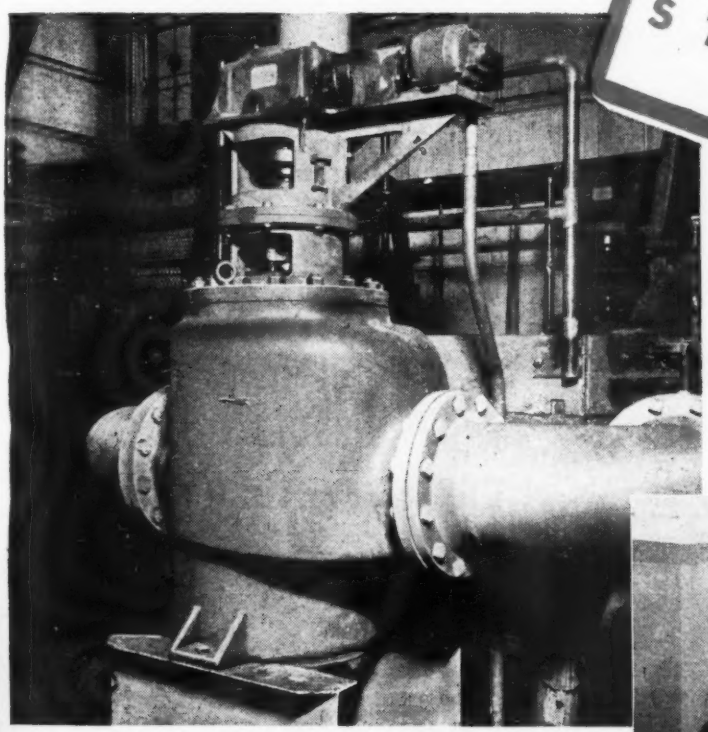


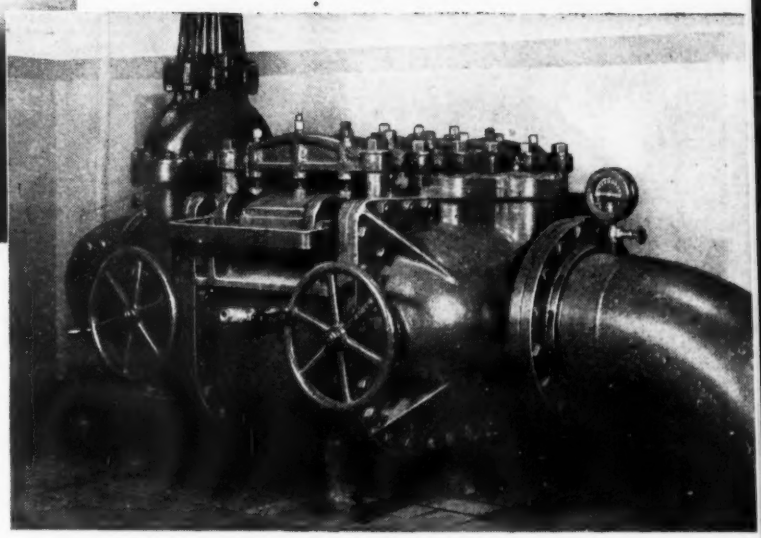
CLOSE-UP OF ELLIOTT DESUPERHEATER in power plant service, showing pressure regulator, and illustrating the compactness of the typical installation. Elliott engineers, expert in desuperheating, are glad to discuss your problem.

power plant operation

IN PHILADELPHIA ELECTRIC COMPANY'S CHESTER STATION, this 16-in. Elliott self-cleaning strainer clears water for cooling bearings. A small proportion of the incoming water is used to back-flush strainer sections blanked off in turn, taking out foreign substances and restoring the section to duty again. These units have been eminently successful in very many installations giving non-stop service with practically no maintenance.

Taking solids out of service water - ELLIOTT STRAINERS





IN A PUBLIC UTILITY STATION, this Elliott 16-in. twin strainer gives constant service. The only attention required is occasional shifting of the straining load from a fouled cylinder to its clean twin. The fouled basket is then removed and dumped. Thousands of these strainers in all sizes, as well as single strainers of equally sturdy design, have built for Elliott the reputation of "Strainer Headquarters." If you have a strainer problem, let us talk it over.

ELLIOTT COMPANY *Accessories Dept.,* **JEANNETTE, PA.**
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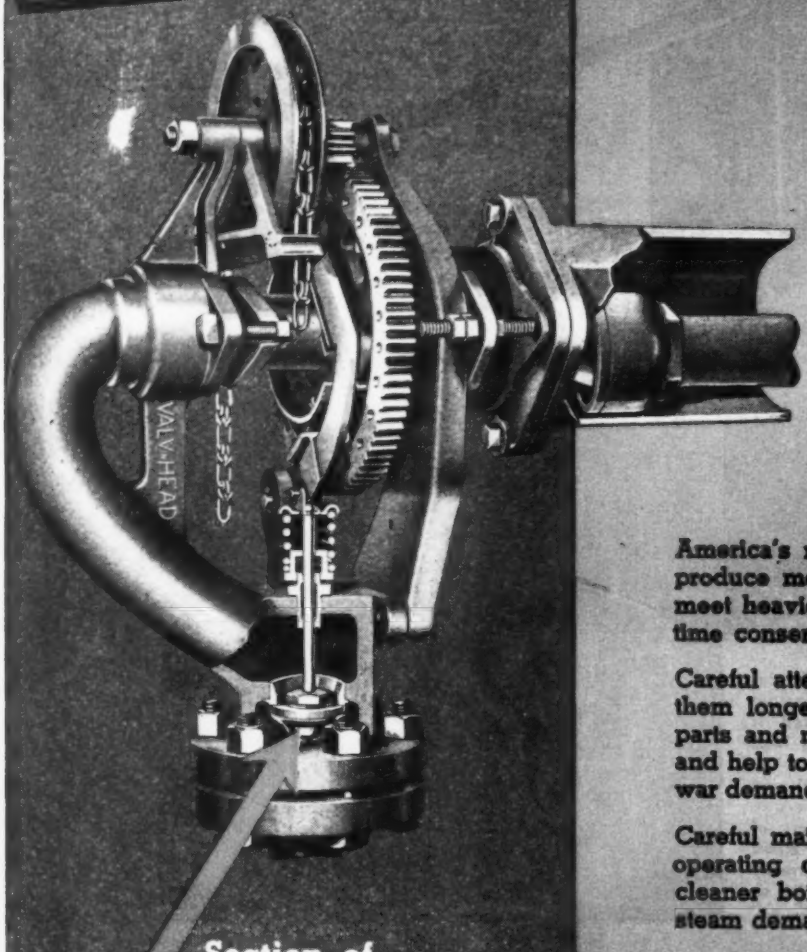
Get LONGER AND BETTER SERVICE FROM THE SOOT BLOWERS YOU HAVE



Section of
G9B SOOT BLOWER
Showing Poppet Valve

Care of

VALVES AND PACKING

SAVES STEAM

★

ASSURES EFFECTIVE BLOWING

★

America's march to victory demands that we all produce more—use less. You are called upon to meet heavier requirements for steam, at the same time conserving materials in every way possible.

Careful attention to your soot blowers will give them longer useful life—will conserve on repair parts and new blowers. It is economy for you—and help to us. We are called upon to meet heavy war demands, too.

Careful maintenance also keeps blowers in good operating condition at all times. The resulting cleaner boilers makes it easier to meet heavy steam demands.

Soot Blower Valves

All valve parts of Diamond G9B Soot Blowers are made of Monel metal or stainless steel. Under normal conditions they require very little attention for a long time. Oil should never be used on valve stems as it may form a gummy deposit

which may cause them to stick. In case a stem sticks, remove and clean it with emery cloth.

Should the valve need regrinding, remove gooseneck flange bolts, then remove cap screws which hold the bottom of the bracket to the gooseneck. Then remove the nut on the inner end of the sheave wheel shaft, which will permit drawing the gooseneck off the swivel tube without disturbing the packing. Take the gooseneck to a bench and regrind or replace the valve in the usual manner. Both valve disc and valve seat are renewable.

The valve may be regreund without removing the head from the boiler. Remove the gooseneck flange bolts and the nuts on the end of the bracket stud. In this way, the entire unit may be pulled out and the gooseneck may be turned to a convenient position for regrinding the valve.

Soot Blower Packing

The G9B Soot Blower is packed around the swivel tube where it enters the gooseneck and also around the valve stem.

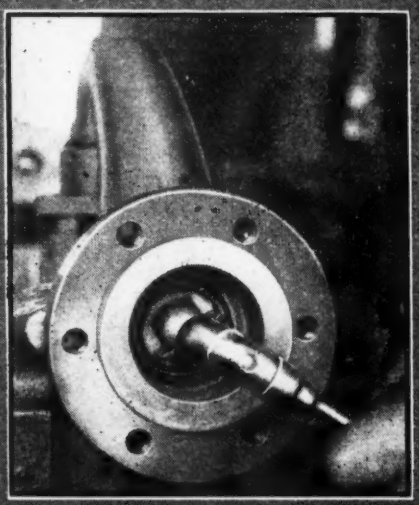
Special grade packing, made up in split rings of the correct size, is kept in stock at our factory.

If leaks develop which cannot be stopped by pulling up on the gland, add one or two rings of this special packing.

If it is necessary to repack the swivel tube gland, remove the gland bolts and pull out the gland far enough to allow insertion of new packing. Replace bolts, tighten as far as they will go. Remove gland again, insert an additional packing ring if possible and then back off the gland bolt nuts one-quarter to one-half turn so the packing will not bind the swivel tube.

To add or renew valve stem packing, remove the valve spring and unscrew the valve stem packing nut. The packing nut can then be filled with packing and replaced. Special tongs are available for removal of the valve spring.

METHOD OF GRINDING
G9B SOOT BLOWER VALVE



Write
For This
Booklet
on Care of
DIAMOND
SOOT BLOWERS

DIAMOND POWER
SPECIALTY CORP.
DETROIT, MICHIGAN
DIAMOND SPECIALTY LIMITED · Windsor, Ont.

THROW YOUR
Scrap
INTO
THE FIGHT

Blazing THE

DOWTHERM

1932 FIRST UNIT

4,000,000 Btu. per hr. capacity

Original Dowtherm Vaporizer installed in 1932 furnishes process heat for chemical production.

Foster Wheeler is a four star winner under the U. S. Navy Board of Awards for production.

• The development of new processes in the early 1930's emphasized the limitations of the high temperature heating methods then available. In that period Dowtherm Vapor heating systems were developed by Foster Wheeler. Utilizing the latent heat from condensing vapor, Dowtherm combines the constant temperature advantage of steam heating with high temperature processing at low pressure.

Precision control of product heating from 400 to 700 degrees F.; ability to maintain uniform surface temperatures; to supply heat at different and varying temperatures from one source of heat; to heat and cool in the same cycle . . . these characteristics of Dowtherm heating have gained the unqualified acceptance of Industry.

FOSTER WHEELER CORPORATION

FOSTER

ENGINEERING TRAIL

HEATING

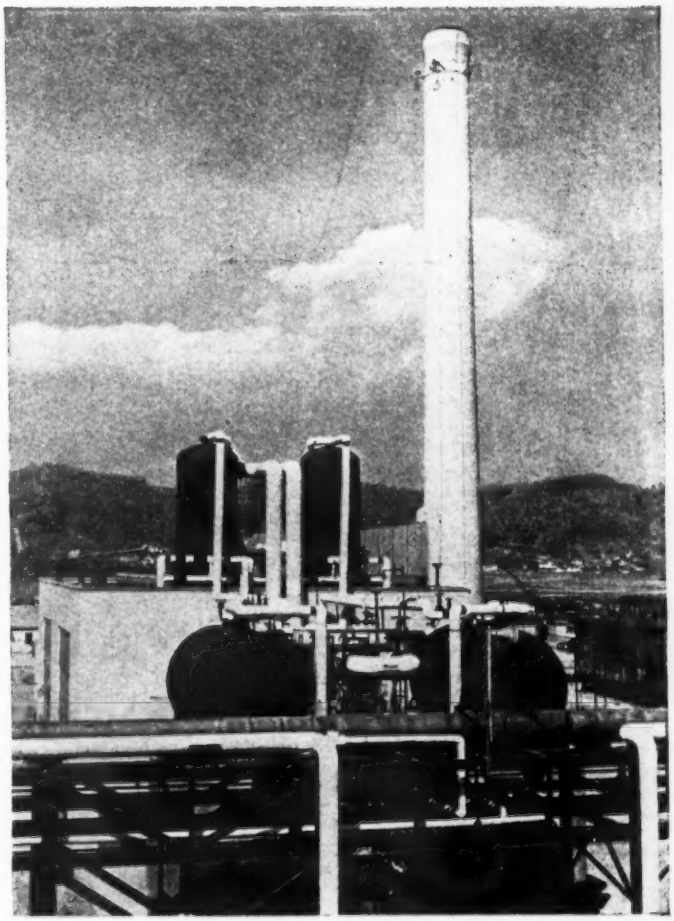
1944 164TH UNIT

35,000,000 Btu. per hr. capacity

• Since the installation of the original Dowtherm Unit for a relatively simple, high temperature chemical operation, the indirect heating system has been successfully adapted to a variety of processes in the chemical, petro-chemical and petroleum industries. Among these applications are:

Synthetic Rubber Production
Edible Oil Deodorization
Bodying of Drying Oils
Synthetic Resin Production
Phthalic Anhydride Purification
Fatty Acid Distillation
Esterification
Fat Splitting
Special Petroleum Processing
Plastic Moulding and Manufacture
Asphalt Processing and Coating
Wire and Cable Manufacture

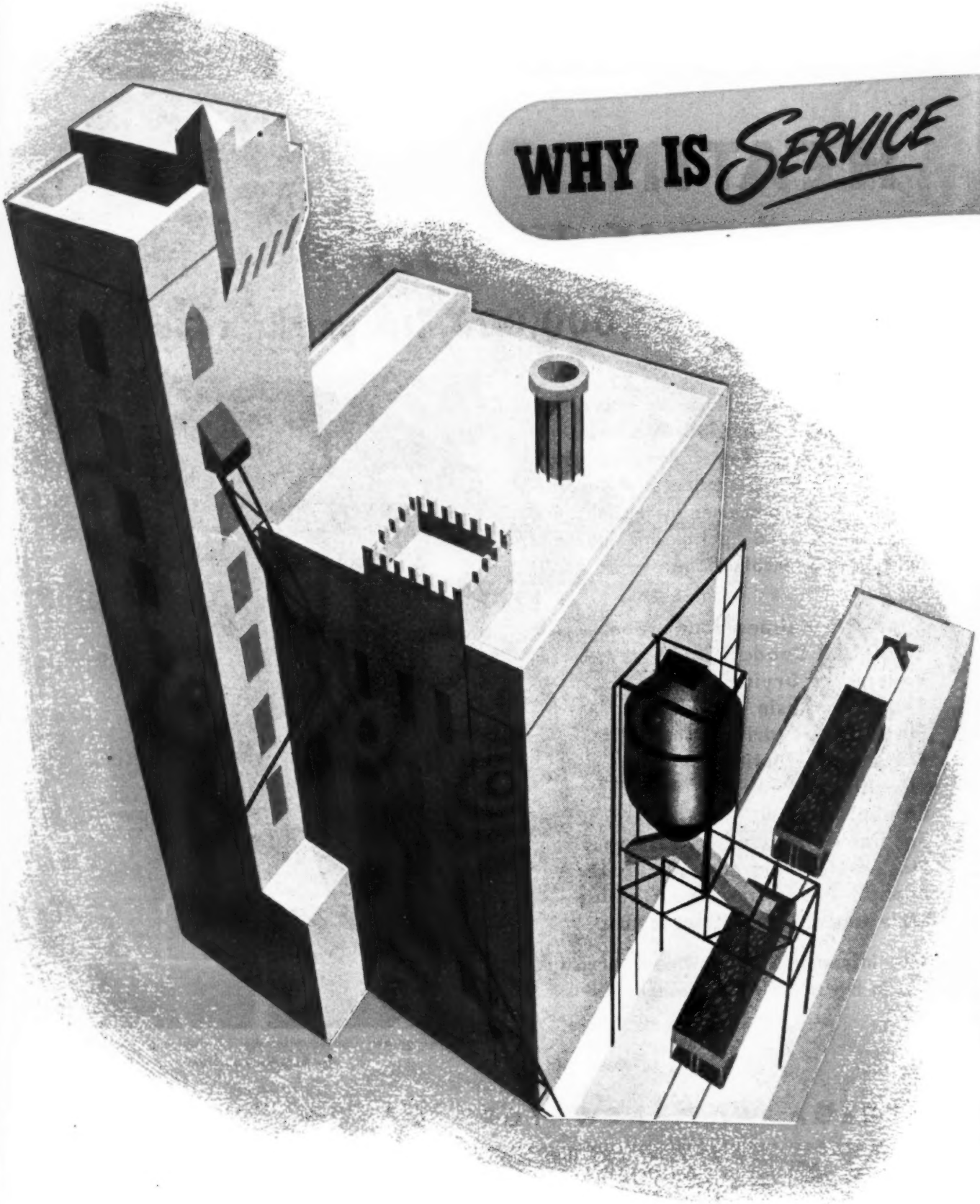
Further information on Dowtherm, including its use in Power Plants, is available in bulletin ID-43-5.



Large new Dowtherm installation supplying process heat for butadiene production.

165 BROADWAY, NEW YORK 6, N. Y.

WHEELER


WHY IS SERVICE

MPORTANT TO STOKER OPERATION?

SINCE a stoker constantly works under heavy operating conditions, it requires some attention and replacement of parts from time to time.

To render good, quick service—especially in emergencies—the American Engineering Company maintains four substantial stocks of replacement parts in strategically located service stations.

Each service station is headed by a manager who has had extensive experience in meeting the diversified conditions of proper service.

To be of further help to you, A-E-CO has a staff of skilled service engineers in the field. These engineers make periodic visits to Taylor installations to check equipment and assist the plant in achieving greater operating economy.

Taylor Stoker Service Engineers are also available at a reasonable charge for customers requiring service beyond the scope of the periodic check up and inspection.

Good service is another plus value in Taylor Stoker's efficient, low cost generation of steam.

JUDGE THE SELECTION OF FUEL FIRING EQUIPMENT BY THESE TWELVE POINTS

1. RELIABILITY—the ability to operate with minimum outage and minimum standby equipment.

2. CAPACITY—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.

3. MAINTENANCE—the ability to operate continuously with minimum repair costs.

4. FLEXIBILITY—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.

5. EFFICIENCY—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.

6. OPERATION—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.

7. ADAPTABILITY—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.

8. FUEL FLEXIBILITY—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.

9. REFUSE DISPOSAL—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.

10. STACK DISCHARGE—the practical elimination of "smoke nuisance" without special equipment.

11. SPACE REQUIREMENTS—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.

12. OBSOLESCENCE—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

A-E-CO TAYLOR STOKERS • LO-HED HOISTS
HELE-SHAW FLUID POWER • MARINE DECK AUXILIARIES

A-E-CO TAYLOR STOKER

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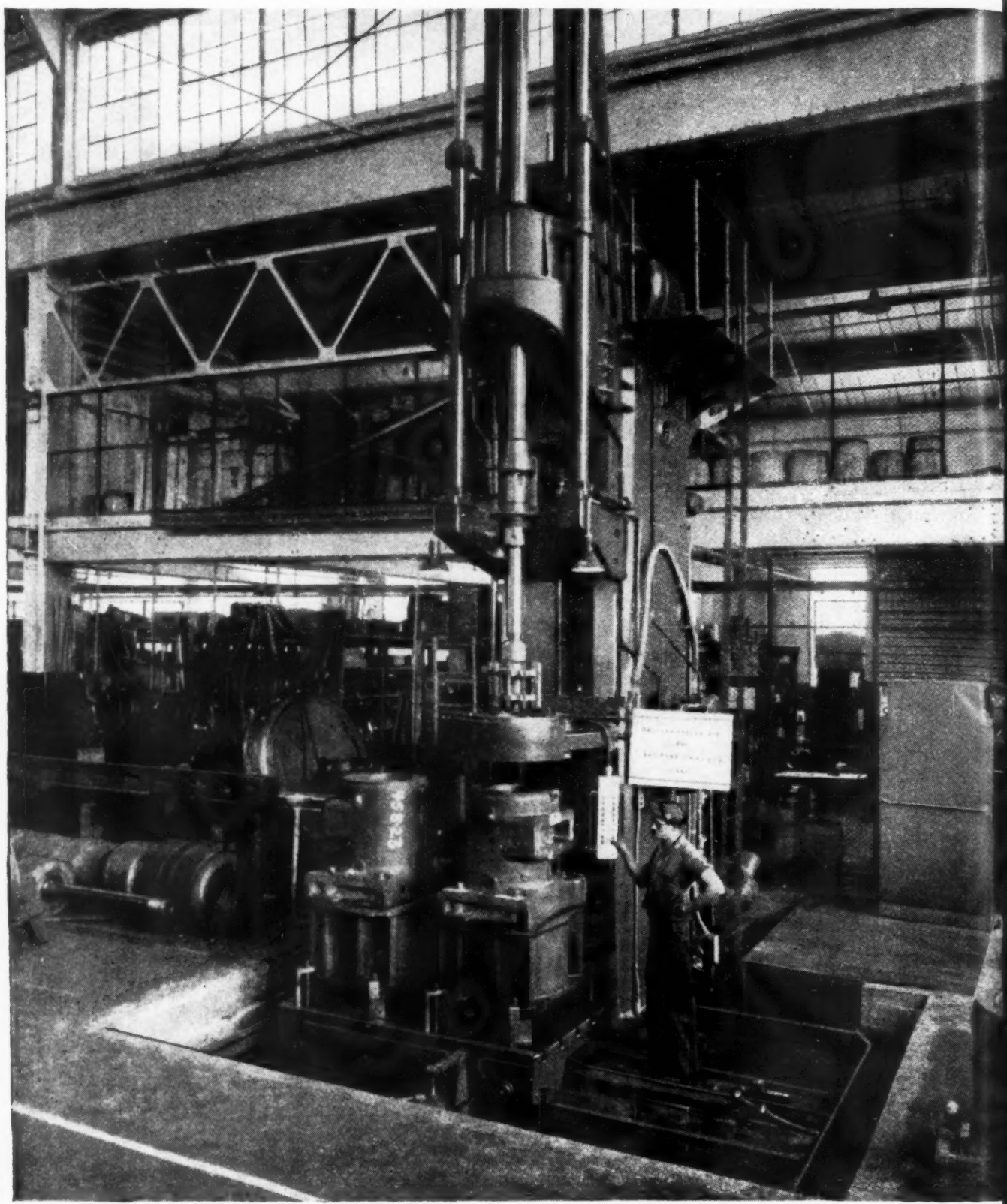


TEXACO

TEXACO

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT — C

Honing BIG Diesels

DIESEL cylinders as large as 26″ in diameter and 7′ 4″ long can now be given the truer surfaces and the closer tolerances possible only with honing. One of the first to apply this method of finishing to BIG Diesels was The Cooper-Bessemer Corporation, one of the nation's leading Diesel manufacturers, who designed and constructed the 20-foot-high honing machine pictured.

On Diesels large or small, finer finishing means more efficient operation . . . particularly when engines are lubricated with Texaco Ursa Diesel lubricants.

Texaco Ursa Diesel lubricants constitute a complete line of oils that prevent scuffing, thereby increasing life of rings, pistons and liners. They keep rings free in their grooves, valves active, ports clear, assuring full piston seal that means maximum economy, and longer periods between overhauls. They also protect modern alloy bearings. Because of these benefits—

More stationary Diesel hp. in the U. S. is lubricated with Texaco than with any other brand.

A Texaco Lubrication Engineer, specializing in Diesel lubrication, will gladly recommend the most suitable type and grade of *Texaco Ursa Oil* for your engines. Phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

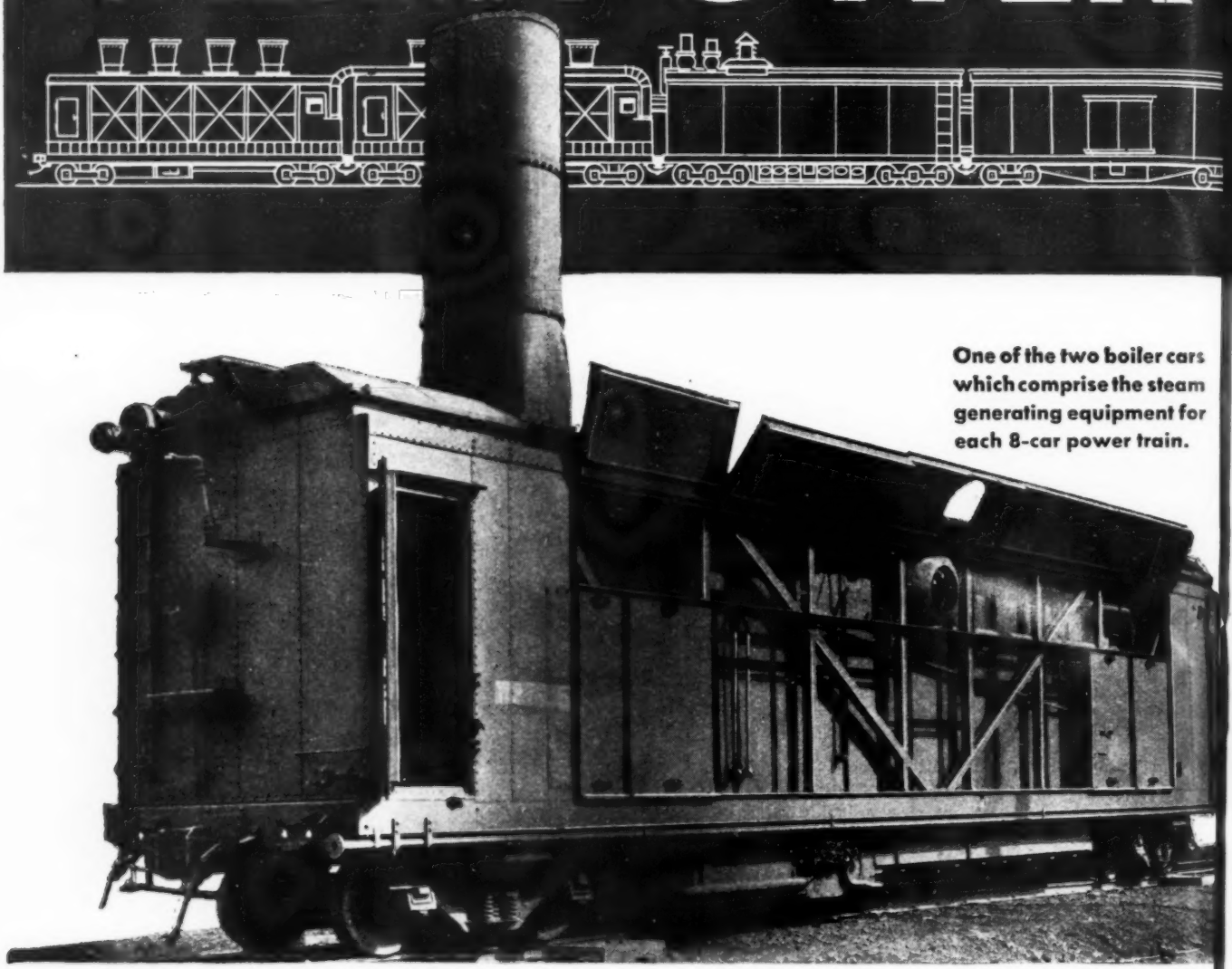
The Texas Company, 135 East 42nd Street, New York 17, N.Y.

Lubricants and Fuels

FOR ALL DIESEL ENGINES

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

SPEEDING POWER



One of the two boiler cars which comprise the steam generating equipment for each 8-car power train.

It takes from nine months to two years to rebuild a bombed or sabotaged power plant. Yet this power plant on wheels can be generating enough electricity for a sizable community within a short time after arrival. It will do this in arctic cold or in tropical heat — on a meager water supply — with low grade coal.

The train consists of two air-cooled condenser cars, turbo-generator car with switch gear, car for auxiliary equipment, water storage car, two boiler cars and a car for the crew.

Ten such trains, each producing 5,000 kw are in process of completion. They are built by Westinghouse with boilers supplied by Combustion Engineering. These are the highest capacity trains being built for overseas use.

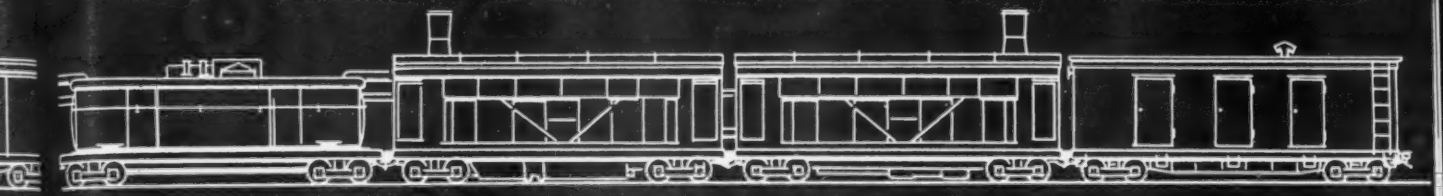
Numerous limitations imposed by space, weight, track clearances and other factors had to be surmounted in designing and constructing these trains. The fact that these unique problems have all been successfully solved is a tribute to the engineering skill and ingenuity of the designers of all the principal equipment comprising these moving power plants.

A814

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

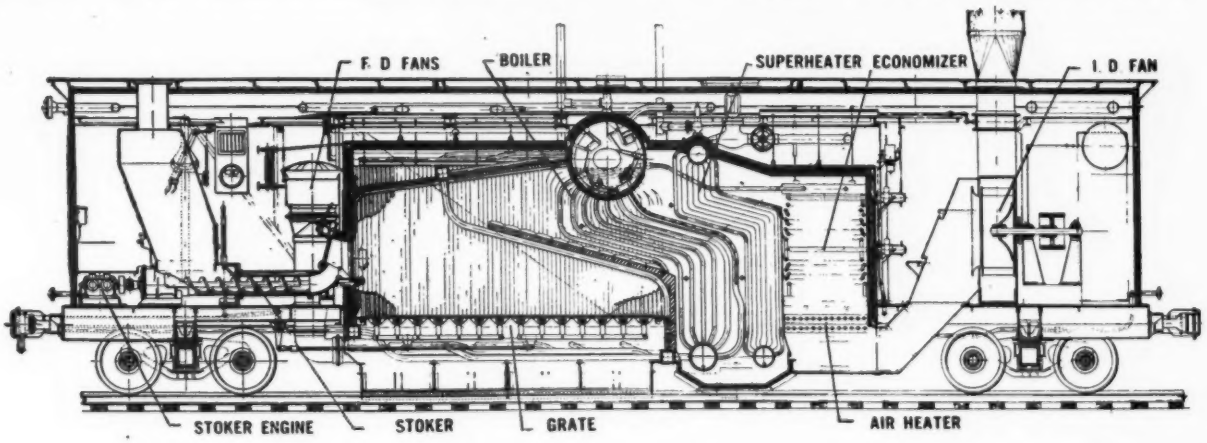
TO WAR-DEVASTATED AREAS



THE BOILERS. Arranged as illustrated in the sectional drawing shown below, the boilers are of the 2-drum, bent-tube type, having a six-steam-pass superheater, a special tubular air preheater and a marine type extended surface economizer. Serving this combination are both forced- and induced-draft fans, a water level regulator and necessary indicating instruments. Each boiler will generate 40,000 lb of steam per hr at 625 psi and 750F at the superheater outlet, from low grade coal of about 7,300 Btu.

FURNACE AND STOKER. Furnace and firing equipment include a locomotive type spreader stoker operating by compressed air, a locomotive type grate, fully watercooled furnace and locomotive type combustion arch. Furnace volume, including that between the arch and first pass, is 553 cu ft, with corresponding heat liberation at design load of 133,000 Btu per cu ft per hr. The arch assures high turbulence and control over excess air and prevents stratification and laning of gas streams.

SPECIAL AIR PREHEATER. Because the stoker engine, stoker jets and soot blowers are all operated by compressed air, the question of compressor power as well as size of this equipment was an important one. It was met by a novel application of a C-E Air Preheater, designed to handle compressed air, which is delivered to the stoker engine and jets at 100 lb pressure and 450F. By this means an adequate volume of air at proper pressure is supplied at a considerable saving in the power required to produce it as well as in the weight of the equipment and the space it occupies.



Combustion Engineering is proud of the important part it has had in this significant achievement. In designing and building the steam generating equipment for the Power Train C-E has again demonstrated its ability to meet any problem within the scope of its field. This ability and the resourcefulness and experience it reflects, are available to you now in finding the best economic solution to your post-war steam generating problems.

COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N. Y.

DETROIT PUBLIC LIBRARY

THERMAL EXPANSION

and what it means when different metals must work together at various temperatures

Two metals, working in adjoining valve parts, obviously need similar thermal expansion properties.

Otherwise, the valve's operation and life would suffer, either from looseness and leakage when cold, or from galling and seizing when hot.

In such applications, therefore, thermal expansion is important chiefly in a *relative* sense. Whether a metal has a high or low rating doesn't matter so much as whether its coefficient corresponds reasonably well with that of the metal used in the adjacent part.

Thermal Characteristics of Inco Nickel Alloys

The INCO Nickel Alloys possess... in addition to their strength, toughness and corrosion-resistance...: heat expansion properties that fit them especially for many power applications.

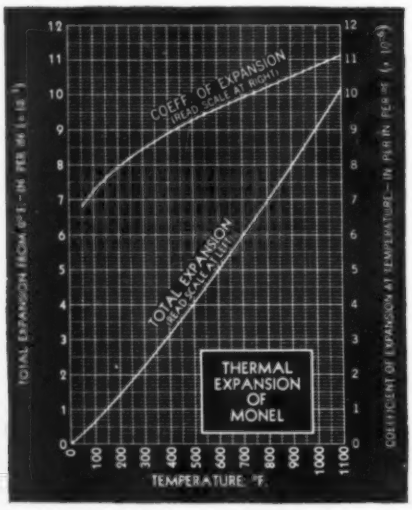
As a group, their thermal expansion about equals or slightly exceeds mild steel, and is somewhat lower than copper alloys. This in-between thermal expansion makes the high-nickel group especially suitable for parts which must maintain precision fits with *either* carbon steels or the brasses and bronzes, in valves and similar appliances.

Data on some of the alloys are shown in the accompanying charts.

What the Charts Illustrate

Each chart shows the total expansion in inches per inch when the alloy is heated from 0° F., to elevated temperatures. The net expansion in inches per inch is found by reading the difference between any two temperatures on the curve. The mean coefficient is found by dividing this net expansion by the number of degrees of temperature difference.

The upper curve of each chart, showing the instantaneous coefficient of expansion at various temperatures, provides a basis of approximate comparison from the standpoint of thermal expansion.

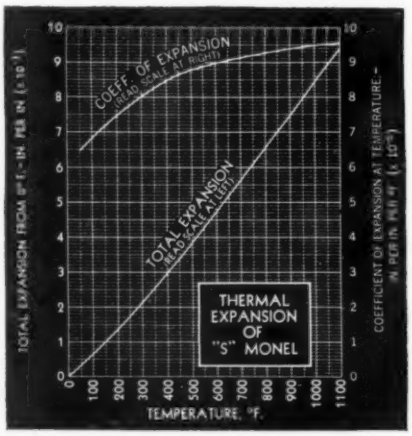


Practical Applications of Inco Nickel Alloys

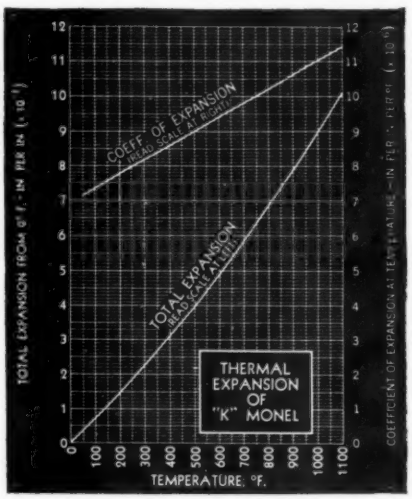
Two illustrations of high-nickel alloys in power applications are shown in conjunction with their corresponding charts.

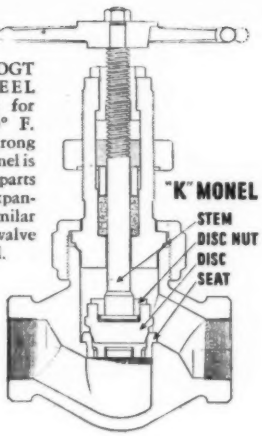
In one instance, "K" Monel is used for the stem, disc, disc nut and seat of a forged steel globe valve, designed for 600 lb. at 950° F. service by the Henry Vogt Machine Co., Louisville, Ky. "K" Monel, in addition to being unusually strong and hard, has the necessary thermal expansion properties to assure good fit with the forged steel body under changing temperature conditions.

In the other application, cast "S" Monel is used for the disc and its cylindrical guide cage in a 12" cast steel valve, made by the Wm. Powell Co., Cincinnati, Ohio. Powell states "the 'S' Monel, heat-treated to 320-350 Brinell hardness, offers a good non-seizing, long-wearing surface for the disc, which is a free floating member, riding up and down within the cage".



12" CAST STEEL toggle-operated non-return valve with welding ends for 1500 lbs. W.S.P. at 900° F. Disc (in foreground) and cylindrical guide are cast "S" Monel, heat treated to 320-350 Brinell for durable non-seizing service.





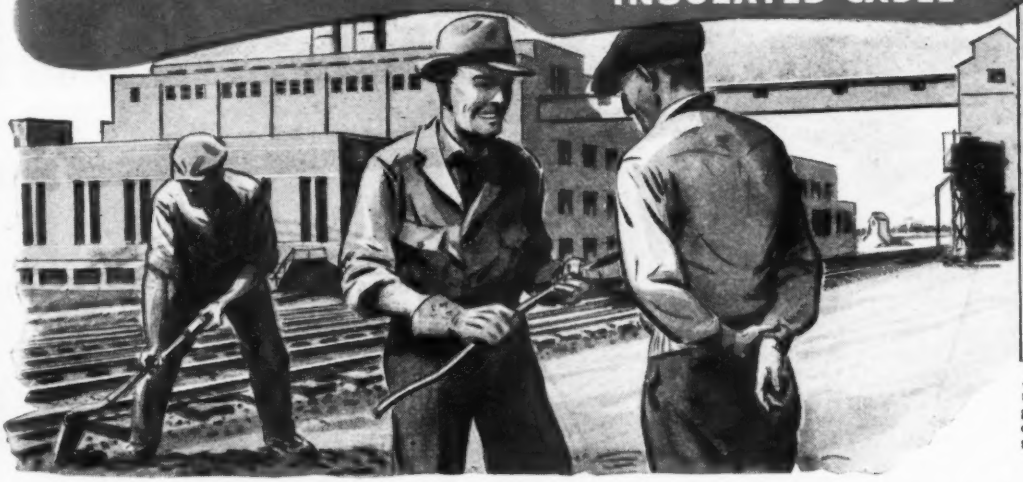
DESIGN OF VOGT FORGED STEEL GLOBE VALVE for 600 lbs. at 950° F. service. Extra strong and hard "K" Monel is used in indicated parts where thermal expansion properties similar to forged steel valve body are essential.

* * *

For additional information about Thermal Expansion... and about other properties important in power applications... write for "The Technical Editor Speaks". Address:

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK 5, N. Y.

Seven-year Burial proves superiority of FLAMENOL INSULATED CABLE



After seven years in series-lighting service, buried directly in the ground, this two-conductor, concentric No. 8 Flamenol cable is still as good as new.

FLAMENOL'S LASTING PROPERTIES GIVE LONG, ECONOMICAL SERVICE UNDER SEVERE OPERATING CONDITIONS

More than six years before Pearl Harbor, an Eastern power company made a direct-burial installation of Flamenol cable. After seven years' service, part of it was removed and the insulation was tested—with these results:

Physical Condition: *Excellent*

Insulation Resistance: *336 megohms per 1000 ft*

Tensile Strength: *2560 lb per sq in.*

Elongation: *220 per cent*

Many thousands of feet of Flamenol have since been installed underground for series lighting and 600-volt power circuits. Tests after varied lengths of service show that physical and electrical characteristics of the insulation remain practically unchanged.

Specially developed for severe operating conditions

Years before any rubber shortage, G-E engineers turned to synthetic resins for improved cable insulation. Flamenol, the first such cable to be utilized commercially, proved vastly superior to rubber-insulated cable for service under adverse conditions.

Today, after years of constant development, Flamenol cable offers a wide range of operating advantages:

FLAME RESISTANCE

Does not support combustion.

CORROSION RESISTANCE

Immune to action of oils, acids, alkalies.

AGING

Does not oxidize. Highly resistant to sunlight and weathering.

PHYSICAL PROPERTIES

Tensile strength, 1500 lb per sq in., minimum. Elongation, 100 per cent, minimum.

DIELECTRIC STRENGTH

720 volts per mil, retained through severe operating conditions.

In addition to these *time-proved* operating advantages, Flamenol cable is easy and economical to install and maintain. That's why millions of feet of this long-lived cable are used for power and lighting circuits in the chemical, food, textile, printing, oil, mining, steel, automotive, railroad, and other industries. For detailed information on uses, constructions, sizes, etc., write for Leaflet GEA-2733D. *General Electric Company, Schenectady, N. Y.*

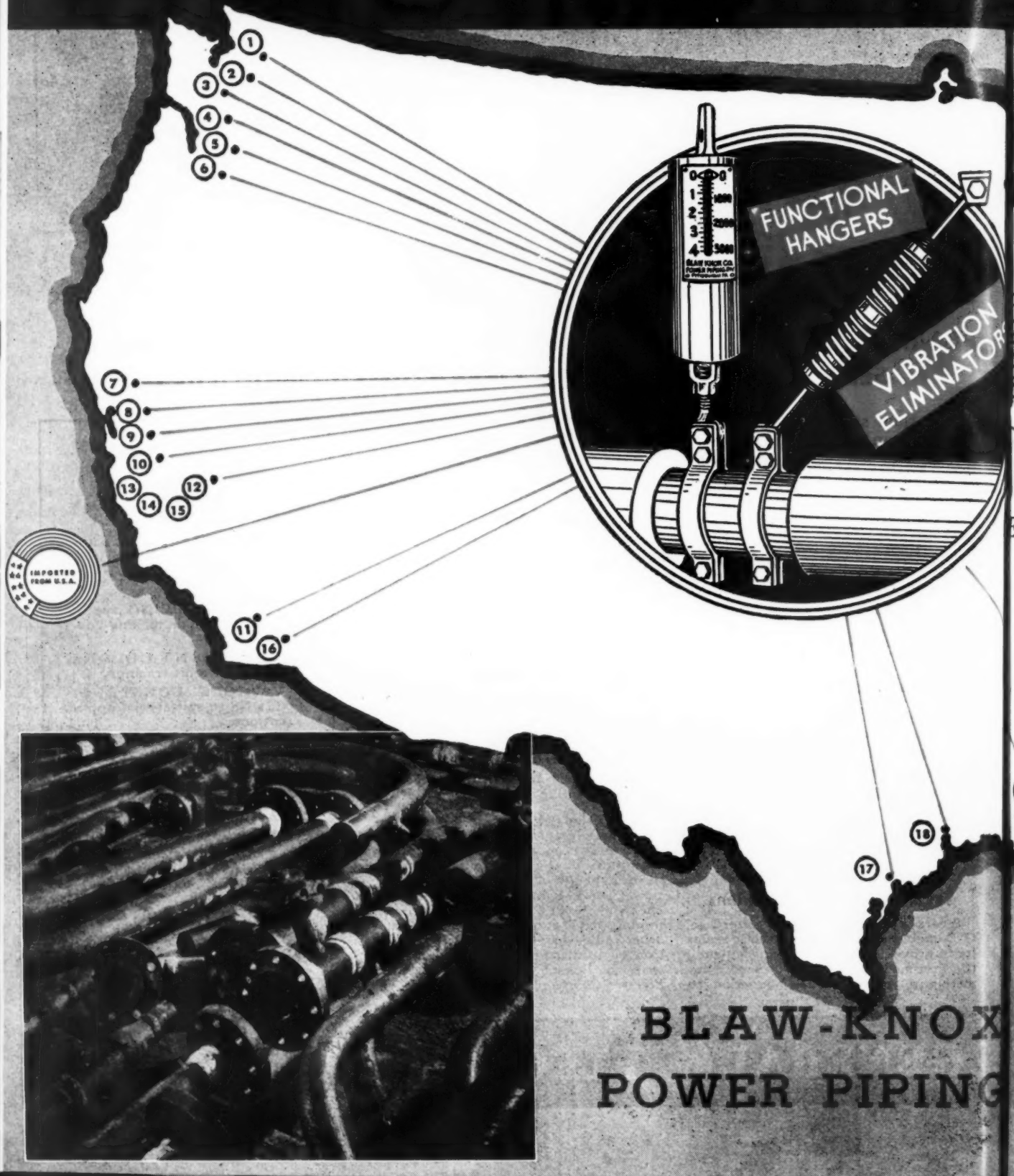
7 Extras That Insure EASY INSTALLATION, ECONOMICAL MAINTENANCE

1. SMALL DIAMETER saves space, facilitates wiring.
2. SMOOTH SURFACE assures easy pulling.
3. FREE STRIPPING speeds splicing, avoids nicking conductors.
4. DIFFERENT COLORS simplify circuit tracing.
5. VARIOUS CONSTRUCTIONS to suit special applications.
6. SELF-PROTECTING finish eliminates need for conduit.
7. RETAINS ATTRACTIVENESS makes re-painting unnecessary.

GENERAL ELECTRIC

502-45-1200

THIS SCIENTIFIC SOLUTION
ENDORSED BY THE NATION'S

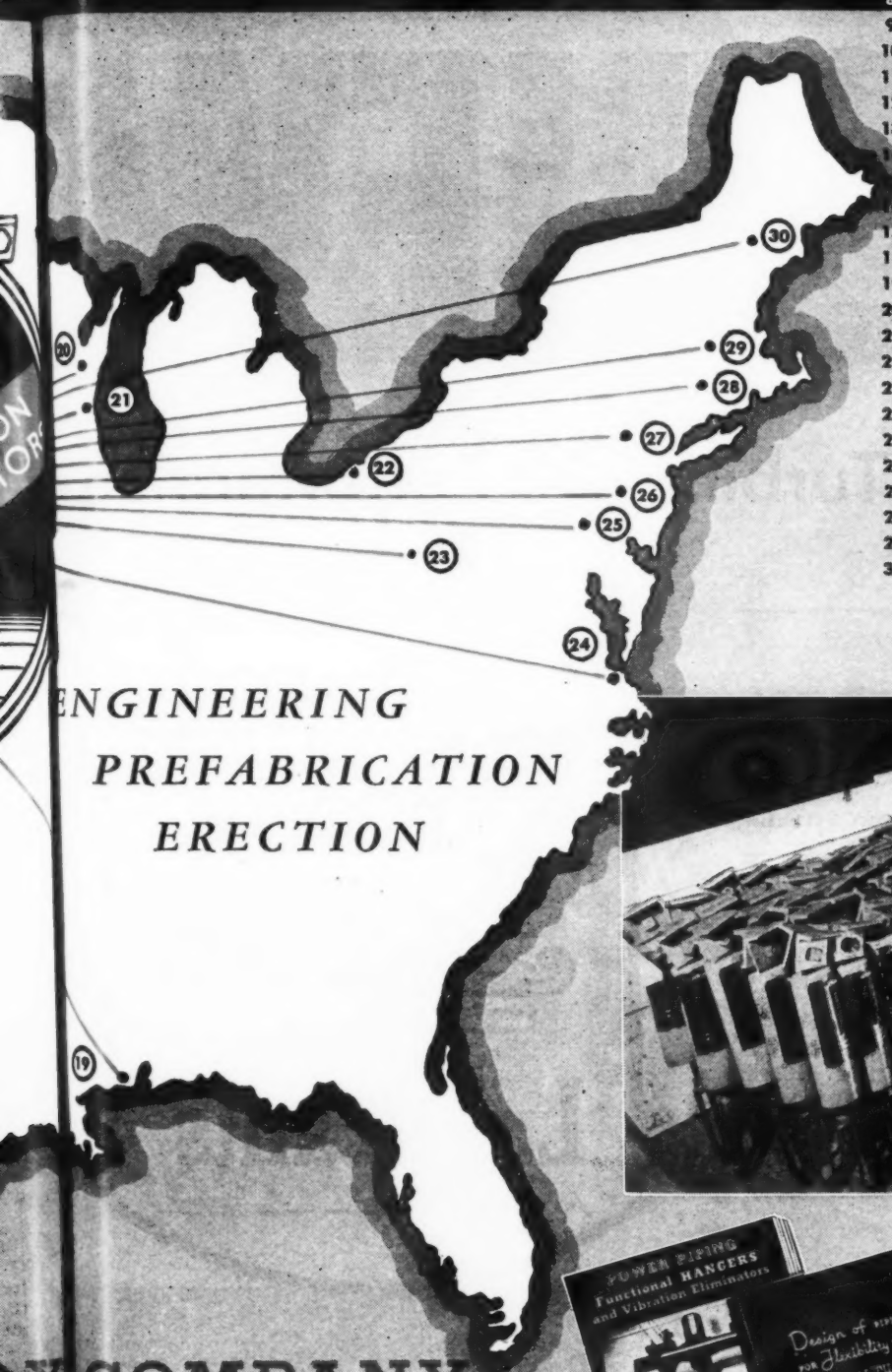


BLAW-KNOX
POWER PIPING

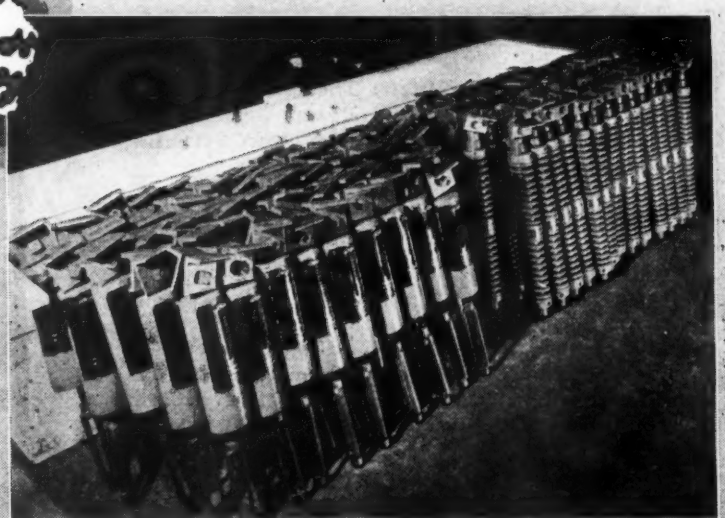
TO PIPING PROBLEMS

SHIPYARDS

1 Puget Sound Navy Yard, Bremerton, Washington
2 Todd-Pacific Shipyards, Inc.—Seattle, Washington
3 Todd-Pacific Shipyards, Inc.—Tacoma, Washington
4 Kaiser Company, Inc.—Vancouver, Washington
5 Kaiser Company, Inc.—Swan Island, Portland, Oregon
6 Oregon Shipbuilding Corp.—Portland, Oregon
7 Moore Dry Dock Co.—Oakland, California
8 Marinship Corp.—Sausalito, California
9 Western Pipe & Steel Co. of California—San Francisco, Cal.
10 Bethlehem Steel Co.—San Francisco, California
11 Bethlehem Steel Co.—San Pedro, California
12 Bethlehem Steel Co.—Alameda, California
13 Kaiser Co. No. 3 Yard—Richmond, California
14 Permanente Metals Corp., Yard No. 1—Richmond, California
Permanente Metals Corp., Yard No. 2—Richmond, California
15 California Shipbuilding Corp.—Wilmington, California
17 Brown Shipbuilding Company—Houston, Texas
18 Consolidated Steel Corp.—Orange, Texas
19 Gulf Shipbuilding Corp.—Mobile, Alabama
20 Garton Toy Company—Sheboygan, Wisconsin
21 Leathem D. Smith Shipbuilding Co.—Sturgeon Bay, Wis.
22 American Shipbuilding Co.—Cleveland, Ohio
23 American Bridge Co.—Pittsburgh, Pa.
24 Bethlehem-Fairfield—Baltimore, Maryland
25 Philadelphia Navy Yard—Philadelphia, Pa.
26 Federal Shipbuilding & Drydock Co.—Kearney, New Jersey
27 Todd Shipyards Corp.—Brooklyn, New York
28 Bethlehem Steel Co.—Staten Island, N. Y.
29 Boston Navy Yard—Boston, Mass.
30 Bath Iron Works Corp.—Bath, Maine
Pacific Bridge Company—Pearl Harbor
Hawaiian Electric Company Ltd.—Honolulu, Hawaii
U. S. S. R.



ENGINEERING
PREFABRICATION
ERECTION



These two books constitute a service offered by Power Piping Division for the benefit of the engineering fraternity and will be sent FREE to any engineer requesting them on his business letterhead.

X COMPANY
NG DIVISION PITTSBURGH PENNA.

NEW GARGOYLE

SETS NEW

...for Turbine Oil Performance

WHAT MAKES A GREAT TURBINE OIL?

√ ***Excellent Base Stock:*** The fundamental requirement for an ideal turbine oil is a base stock that in itself is an excellent turbine oil with excellent resistance to oxidation.

√ ***Extra Resistance to Oxidation:*** Oxidation protection—PLUS—is needed to meet the effect of greatly increased temperatures in modern turbine operation. Your turbine oil should have this PLUS protection.

√ ***Maximum Anti-Rust Qualities:*** The possibility of the presence of water demands that the oil should furnish maximum protection against corrosion. Your turbine oil should give this protection.

THE NEW GARGOYLE D.T.E. OIL 797 HAS ALL OF THESE NECESSARY CHARACTERISTICS

GARGOYLE

Lubricants

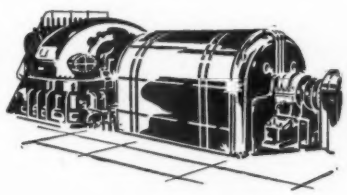
FROM THE WORLD'S LEADER IN LUBRICATION:

D.T.E. OIL RECORDS!

under Severe Operating Conditions

TODAY'S increased steam pressures and temperatures called for this great new turbine oil. So—here it is—the answer to the most severe turbine operating conditions.

Gargoyle D. T. E. Oil 797 has a base stock that is, in itself, an excellent, long-lasting turbine oil. To this superior base stock, we've added extra resistance to oxidation and rust.



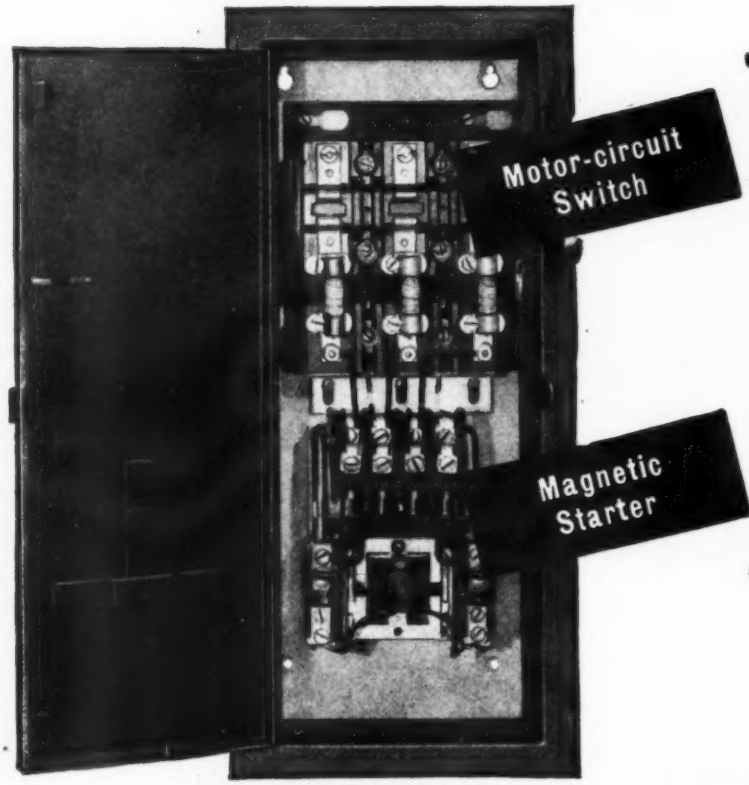
The result is the ideal turbine oil, an oil that has already proved its superiority over all other turbine oils in severe tests, an oil that is already setting new standards of performance in all-size turbines.

Ask your Socony-Vacuum representative for full details ...for interesting performance figures. He'll be glad to give you all the details.

SOCONY-VACUUM OIL COMPANY, INC., Standard Oil of N. Y. Div.• White Star Div.• Lubrite Div.• Chicago Div.• White Eagle Div.• Wadhams Div.• Magnolia Petroleum Co.• General Petroleum Corporation of California

Socony-Vacuum Oil Company, Inc.

EVERYTHING YOU NEED to



110 to 600 Volts

COMBINATION STARTER

Why two devices? ONE can do the job.

GENERAL PURPOSE

Type 1 enclosure for indoor applications where atmospheric conditions are normal. Available up to and including NEMA Size 5.

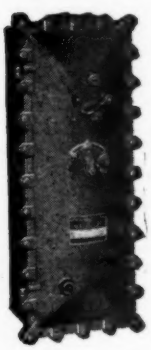
CORROSION-RESISTANT

Two forms are available —Type 3 for corrosive atmospheres; Type 8 for hazardous locations. All arcing parts and terminals of Type 8 forms are at least six inches under oil.

DUST-TIGHT

Type 5 enclosure for use in steel mills, cement mills, and other locations where the dust content of the atmosphere is so high as to make a dust-tight case desirable.

FOR HAZARDOUS LOCATIONS



Type 7 case for Class I, Group D, locations is made of cast, high-strength alloy. Designed to withstand internal explosions.

WATER-TIGHT

Type 4 case is suitable for outdoor use, and for damp places indoors, such as dairies, breweries, and piers.

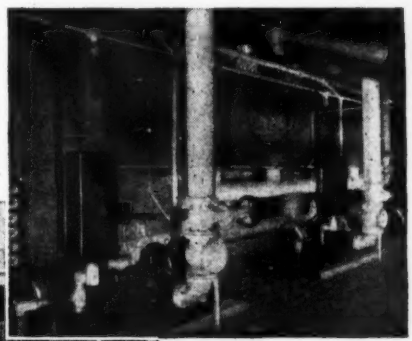
control and protect your motor in ONE COMPACT CONTROL UNIT

COMPLETE full-voltage control of squirrel-cage motors or the primary control of wound-rotor motors—with extra safety, very low installation cost, good appearance, and other advantages.

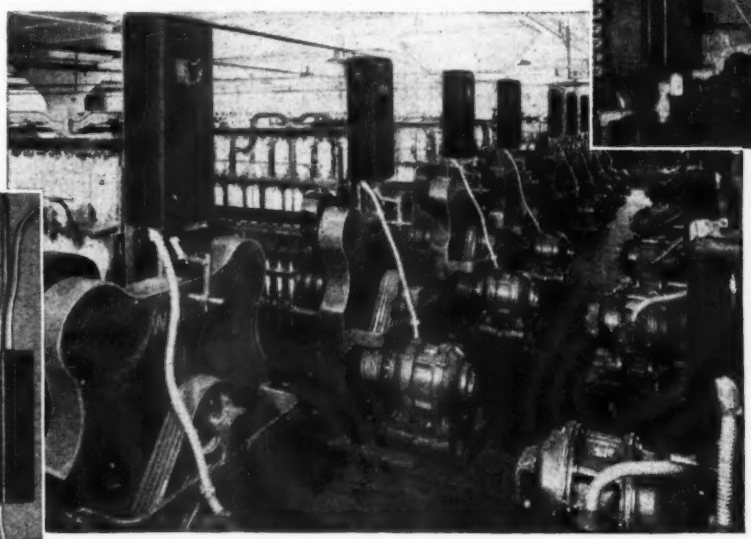
Which Type Do You Need?
If you want short-circuit protection, you can select a starter which has a fusible motor-circuit switch or a breaker to provide such protection. Or, if you do not need short-circuit protection, you can choose a starter which is equipped with a nonfusible motor-circuit switch that serves only as a disconnect. Both types are available in a variety of enclosing cases, as shown on the opposite page.

Co-ordinated for Protection
With G-E combination starters, you're sure that the motor-circuit switch or breaker has the proper rating for the magnetic starter with which it is used. The fuses or breakers provide adequate short-circuit protection to the motor, the starter, and subsequent motor-branch-circuit conductors when connected to a power supply for which they are recommended. The co-ordination of thermal overload relays with the fuses or breakers affords complete motor overcurrent protection under any condition of operation.

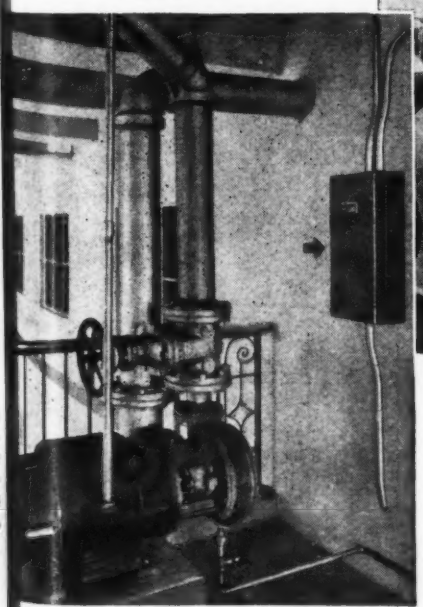
Increased Safety
By placing the motor-circuit switch in the same case with the magnetic starter, the switch can be mechanically interlocked with the cover, so that the cover cannot be opened while there is power on the starter. This is an important advantage because, when a separately mounted switch and starter are used, there is nothing to prevent the operator from opening the case while the starter is "hot."



G-E combination starters can be mounted on or near the machine even in damp locations, such as this pump-room installation.



Combination starters and shipper-rod switches are used to control the operation of each frame operated by this spinning-frame drive.



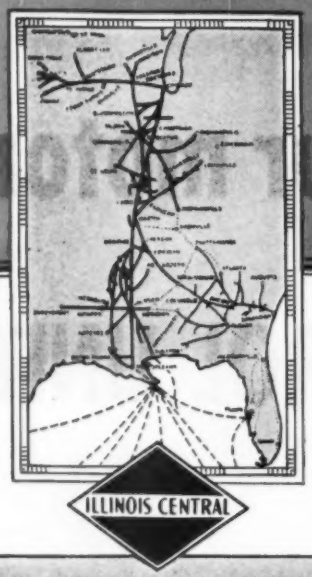
This combination starter controls a ball-bearing splash-proof motor direct-connected to a centrifugal mash pump in a brewing plant.

WANT MORE DATA? More complete information on G-E combination starters will be found in Bulletin GEA-3715. Ask our nearest office for a copy or write direct to General Electric Company, Schenectady 5, N. Y.

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds

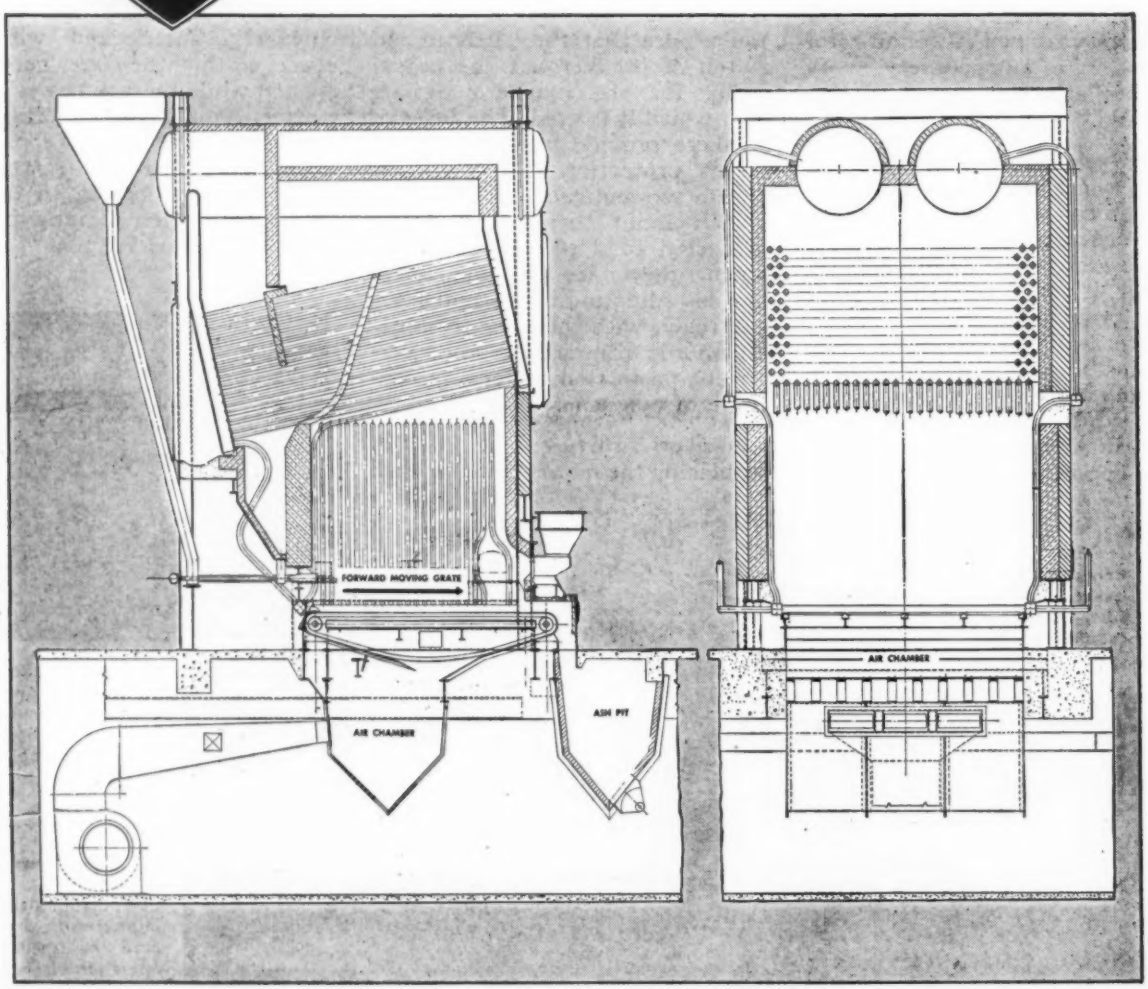
GENERAL ELECTRIC

670-150-8920



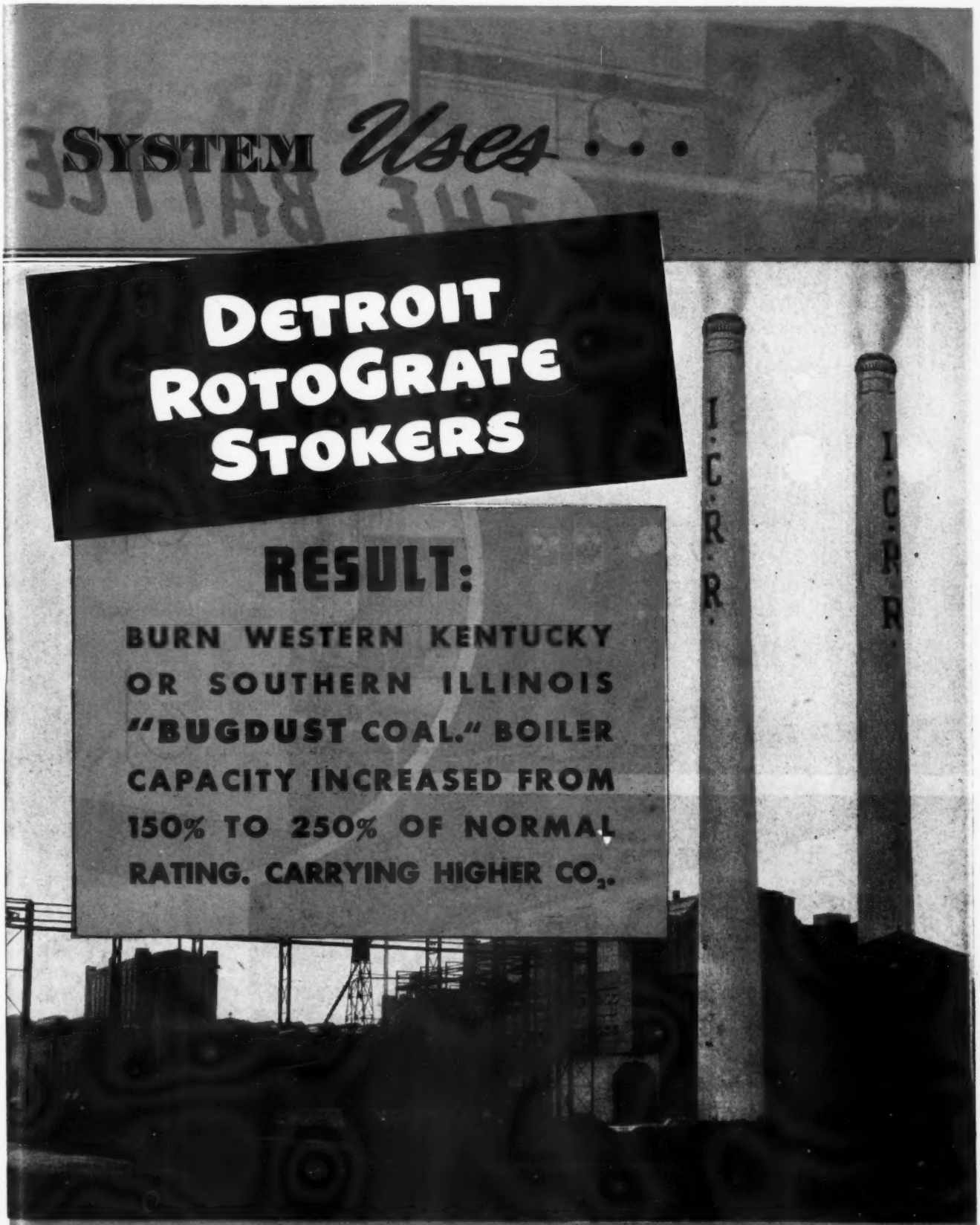
ILLINOIS CENTRAL

RotoGrate is a CONTINUOUSLY CLEANING spreader stoker with a FORWARD MOVING GRATE that permits higher burning rates with fuels of either high or low ash content.

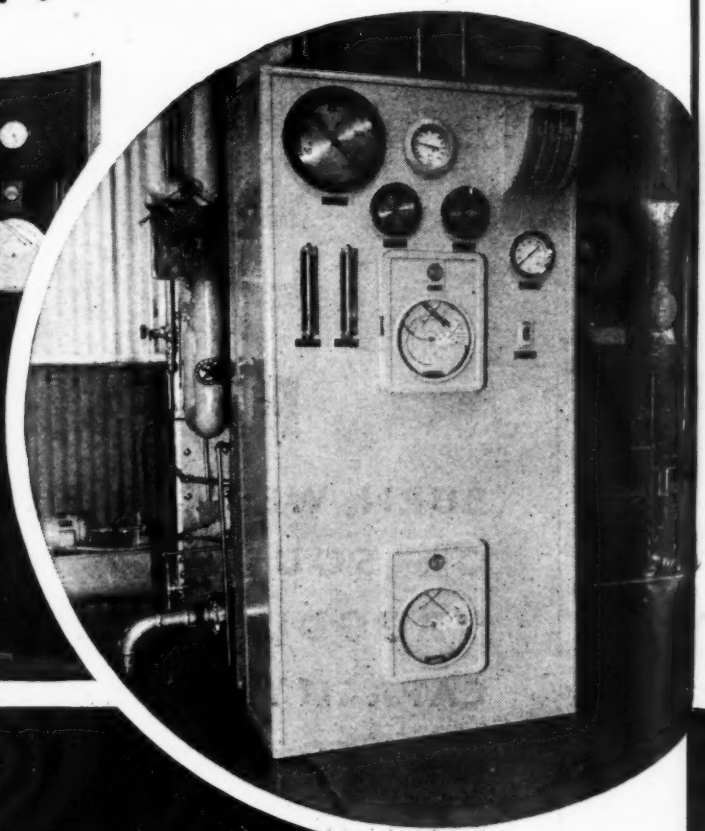


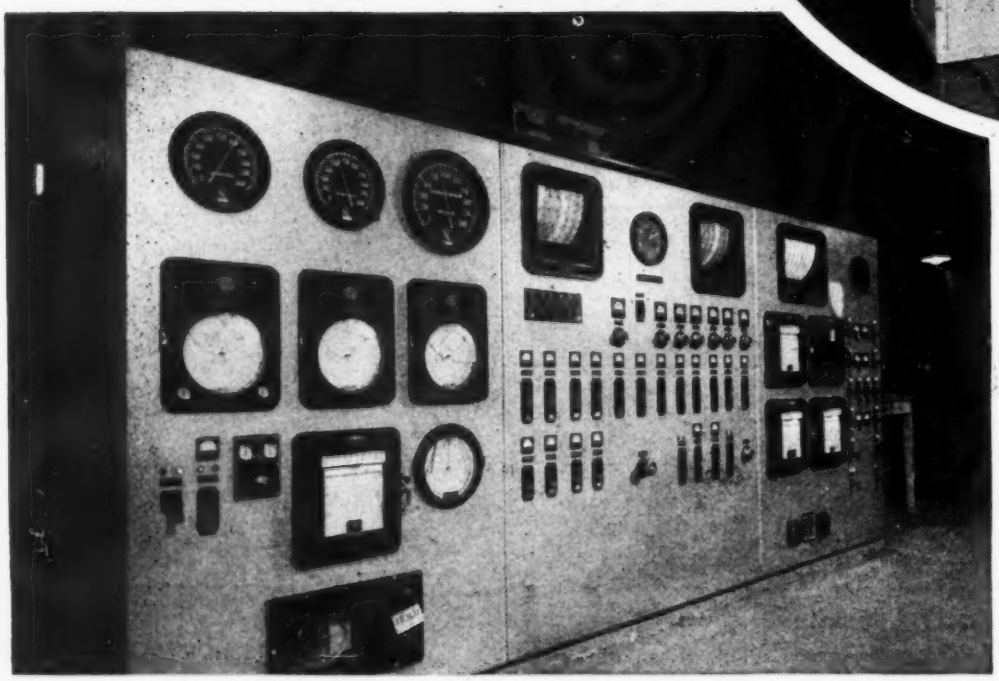
Modernized boilers with water walls and RotoGrate Stokers at Padutah

DETROIT STOKER COMPANY


SYSTEM Uses . . .
DETROIT ROTOGRATE STOKERS
RESULT:
BURN WESTERN KENTUCKY OR SOUTHERN ILLINOIS "BUGDUST COAL." BOILER CAPACITY INCREASED FROM 150% TO 250% OF NORMAL RATING. CARRYING HIGHER CO_2.
I.C.R.R.
I.C.R.R.
Illinois Central Railroad • Paducah, Kentucky
GENERAL MOTORS BUILDING • DETROIT 2, MICHIGAN
Works at Monroe, Michigan • District Offices in Principal Cities • Built in Canada at London, Ontario

THE BATTLE





Bailey Meters and Control save both fuel and manpower by automatically maintaining optimum conditions in the generation and utilization of heat units.

BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT

FOR FUEL

★ Early victory on the battlefield will not cancel the battle for fuel—it will be fought in fuel-burning plants everywhere this winter. In the case of coal, it is estimated that requirements will exceed production by 30 million tons. Since stock piles are at an all time low, rigid conservation must be practiced.

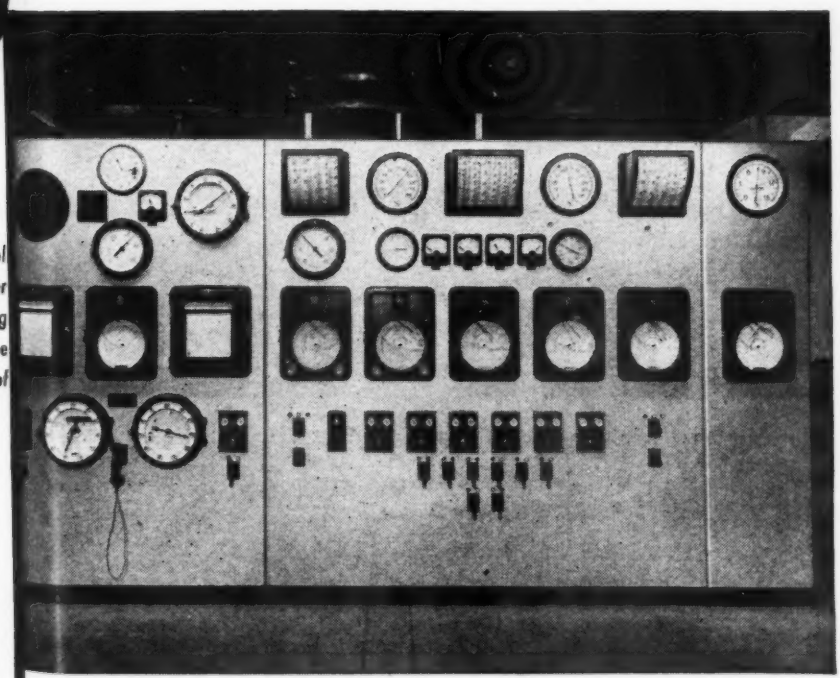
It is the duty of every Engineer who is responsible for the burning of fuel to cooperate with the National Fuel Efficiency Program. He should give careful attention to economy in both the generation and utilization of steam and heat. In this task Bailey Meters and Bailey Meter Control provide the means for—

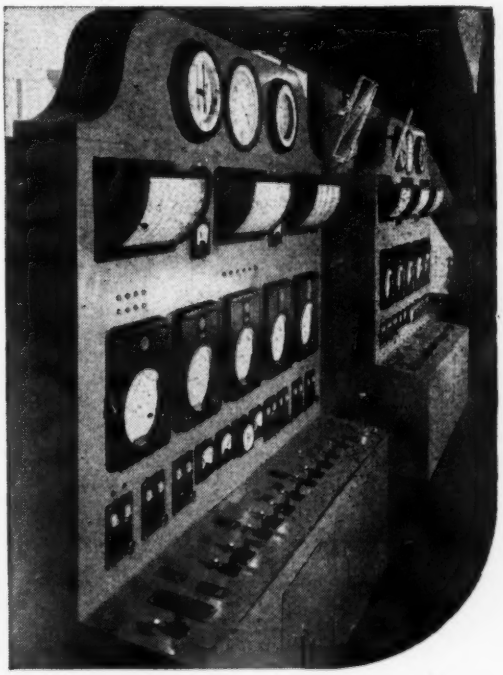
1. Determining true combustion conditions.
2. Accurately measuring and recording heat units both at the point of generation and at the point of consumption.
3. Duplicating conditons which have been determined by test to result in the highest economy.
4. Continuously and automatically maintaining optimum conditions during routine operation.

How Bailey Equipment and Bailey Field Engineers help you to save both fuel and manpower is outlined in Bulletin 15-B. Write for your copy today.

G-23

BAILEY METER COMPANY
1036 IVANHOE ROAD • CLEVELAND 10, OHIO
Bailey Meter Company Limited, Montreal, Canada

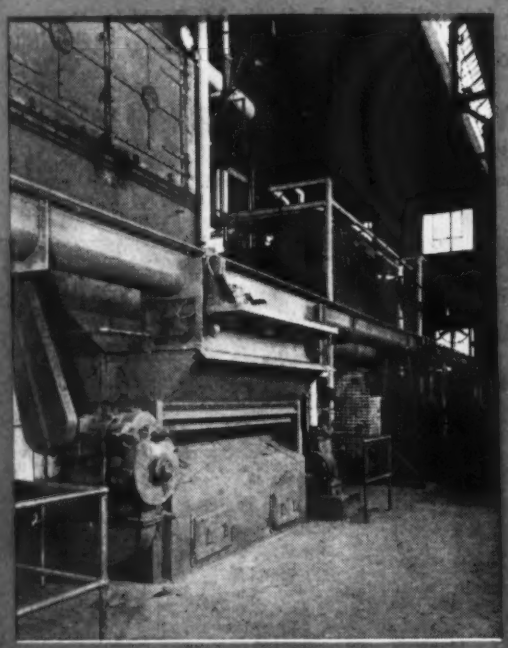




. . . The Complete Boiler Control System

. . . TROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

FAIRFIELD



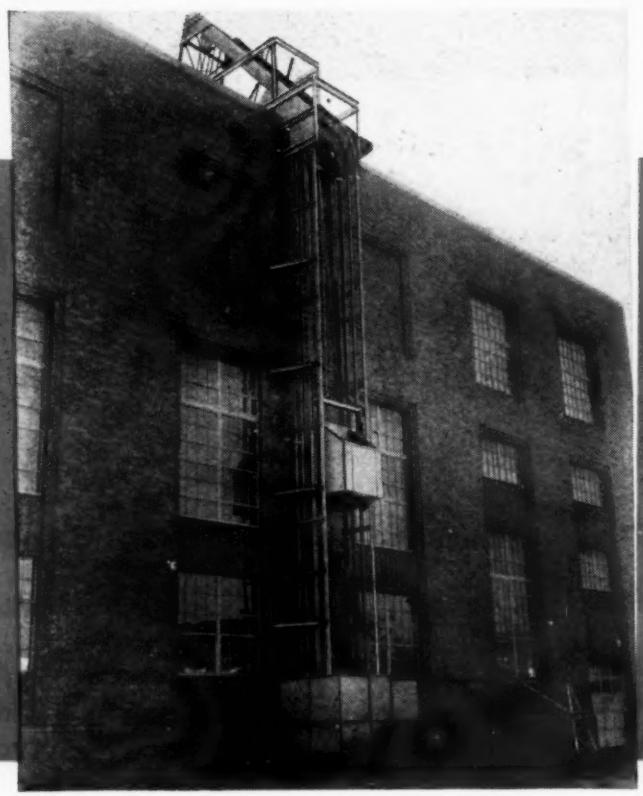
● One of the most advantageous points in specifying the Fairfield System of Coal and Ash handling is placing the entire responsibility of design, construction, and erection of the entire system in one organization.

Another advantage is that Fairfield engineers the job to fit in with your present plant and facilities—no changes in present structures are necessary.

Also Fairfield Engineers have an intimate knowledge of the field plus a wide experience in the installation of many successful units.

The system can be made to meet your specific needs—can be set up to handle storage and flow of coal to boilers—or can include a complete ash handling plant.

The Fairfield Silo System handles coal automatically from car to storage to stoker or pulverizer free from dust and dirt. The Silos are made of vitrified tile—are of circular design—and are located outside the boiler room.



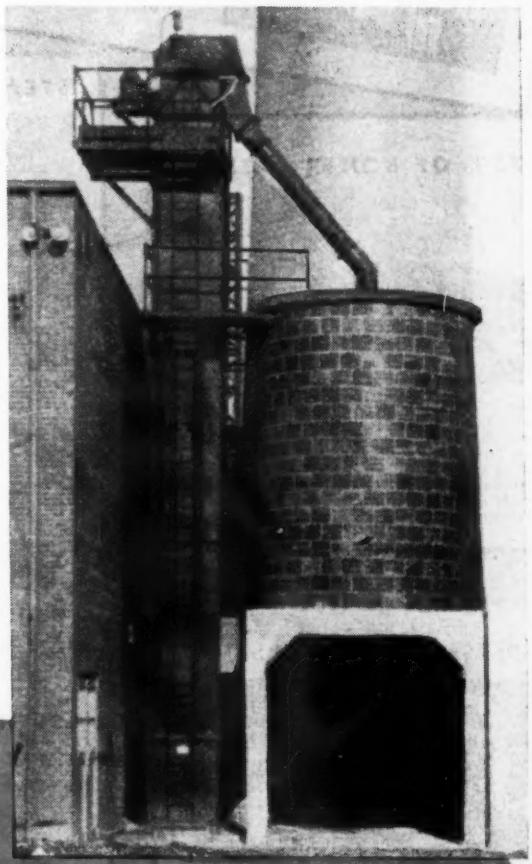
SKIP HOIST

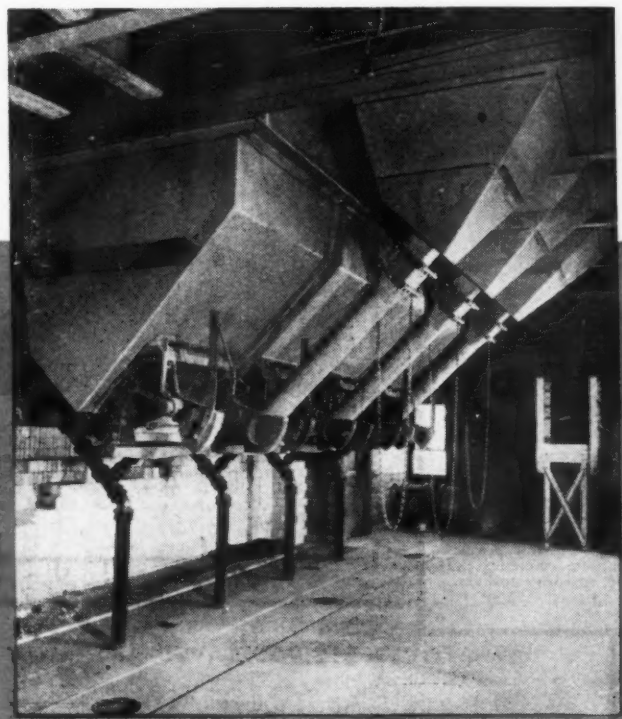
The Skip Hoist shown is handling 50 tons of coal an hour to coal bunker which supplies fuel to two 100,000 lb. boilers. (Municipal Electric Plant—City of Owensboro, Ky.)

provides a complete system for coal and ash handling

On the opposite page two methods of elevating coal are illustrated. The top illustration shows a bucket elevator discharging coal into a silo. Directly below this is a screw conveyor used for distribution of fuel to stokers—a weigh larry is frequently used for this purpose. At the bottom of the page is pictured a skip hoist for discharging coal into bunker.

The illustration at the upper-right of this page shows an outside vitrified tile ash bunker into which ashes are delivered by means of an elevator. Trucks can then back under the bunker to load. Below is shown Fairfield Hoppers located below the boiler room floor with air and water tight gates. Ashes and siftings are discharged by means of the gates into cars for disposal. Both systems keep dirt out of the boiler room—both are equally efficient.





Above is shown an outside Fairfield ash bunker at a prominent enameling plant.

At the left are typical Fairfield Hoppers handling ashes, siftings and soot from 155,000 lb. boilers at a power station.

THE FAIRFIELD ENGINEERING CO.- MARION, OHIO

BUILDERS OF COAL AND ASH HANDLING EQUIPMENT

IRON FIREMAN *Proved* in these

COAL SAVED WITH ⅓ LOAD INCREASE

The F. B. Huxley & Son Company, Ontario, N. Y., largest eastern food dehydration plant installed a dual-nozzle Iron Fireman Pneumatic Spreader. Frank Vandewater, superintendent, says: "When we were hand-firing, 20 tons of coal a day were used. Now, we have increased our load ⅓, yet we use only 18½ tons per day."

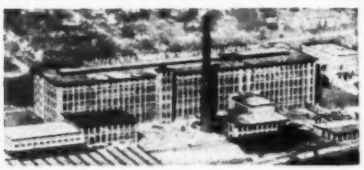
40,000 POUNDS OF STEAM PER HOUR

The Hartsville Print & Dye Works, Hartsville, S. C., installed these three Iron Fireman Pneumatic Spreader stokers to develop capacity to meet a maximum steam demand of 40,000 lbs. per hr. Fuel cost per thousand lbs. of steam has been reduced 21½%. Total investment was liquidated in 12 months.

175% OF BOILER RATING

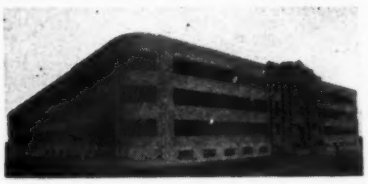
The Indianapolis Drop Forging Company, Indianapolis, Ind., whose purchasing agent, Fred Barnikol, says average savings with two Iron Fireman Pneumatic Spreader stokers run over $600 per month. Four 200 h.p. boilers are fired and carry a peak load of about 175% of rating, no small factor when wartime demands call for peak production.

STEAM COSTS CUT 32%



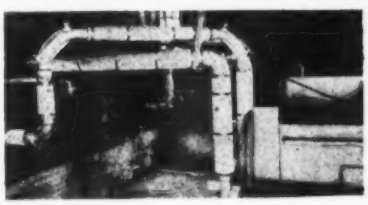
The Pacolet Mfg. Company plant, New Holland, Ga., where the installation of Iron Fireman Pneumatic Spreader stokers cut steam costs from $0.349 to $0.237 per thousand pounds, a reduction of 32%. Fuel savings amounted to $14,784 a year. Marshall C. Stone, vice president and general manager, says "The investment will be self-liquidating in a very short time."

79.6% BOILER EFFICIENCY



Wyndmoor Laboratory, U. S. Dept. of Agriculture, Wyndmoor, Pa., where official tests by the U. S. Bureau of Mines Fuel Economy Service showed the boiler efficiency to be 79.6%, approaching the maximum for simple boiler design without extended-heating surface. Three 2000 lb. per hr. Iron Fireman Pneumatic Spreader stokers produced this remarkable result.

GREATER LOAD—COAL SAVED



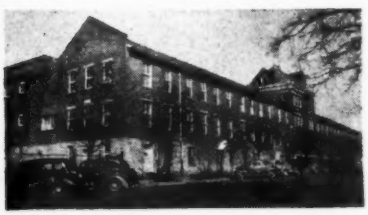
The Giant Grip Mfg. Co., Oshkosh, Wis., increased steam load 30% on existing boilers with this Iron Fireman Pneumatic Spreader stoker. Five steam hammers, that couldn't be used before for lack of steam, are now in full and efficient operation. Iron Fireman handles this greater load on one ton *less* of coal per day.

THE IRON FIREMAN

BOILER CAPACITY UP ... COSTS DOWN

The Belden Mfg. Co., Richmond, Ind., attained a required increase in the capacity of existing boilers and at the same time reduced operating cost by $3293 annually with Iron Fireman Pneumatic Spreader stoker firing. This company particularly appreciates the use of local and low-priced coal, handled with complete efficiency by Iron Fireman Pneumatic Spreader stokers.

PRODUCTION DOUBLED



The American Pad & Textile Co., Greenfield, Ohio, has had production doubled by war orders, and yet with Iron Fireman Pneumatic Spreader stoker firing, the plant has been able to operate with the same boilers as before, and *with no increase in fuel costs.*

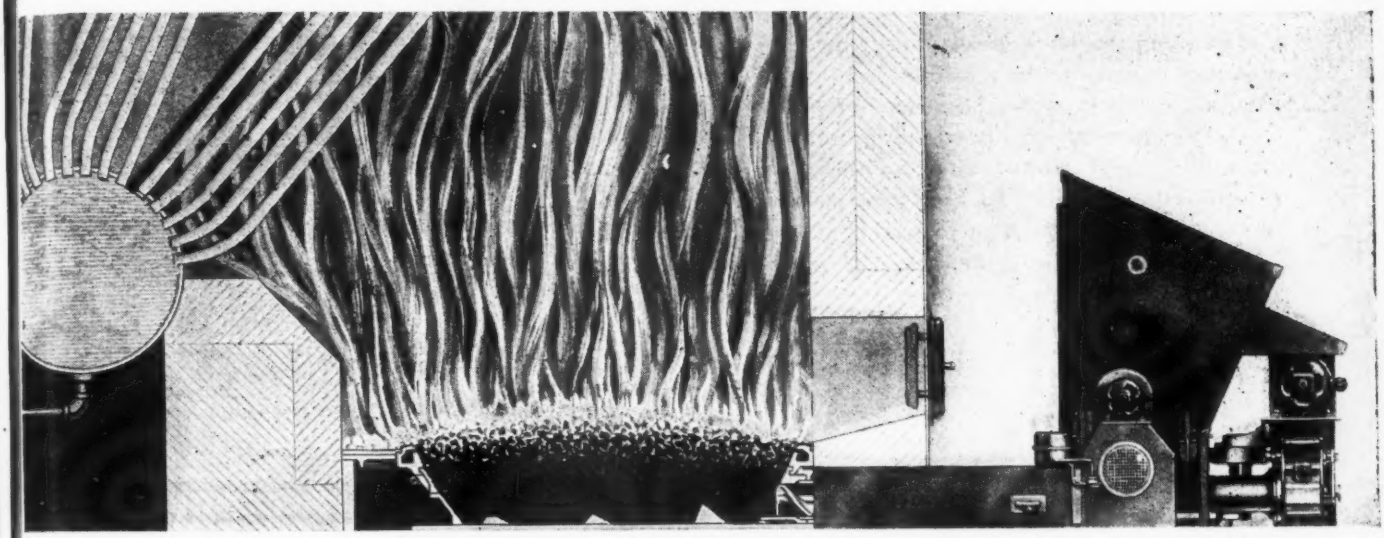
EXTREME LOAD FLUCTUATIONS HANDLED

St. Mary's Woolen Mfg. Co., St. Mary's, Ohio, found this Iron Fireman Pneumatic Spreader stoker installation the answer to great fluctuations in steam demands for processing. Phil Herzing, president, says: "We find that in spite of extreme peaks and subsequent rapid falling off, we can hold our steam pressure to within a variance of two pounds. We consider this superb performance."

OVER $12,000 SAVED ANNUALLY

The Halltown Paper Board Co., Halltown, W. Va., installed these Iron Fireman Pneumatic Spreader stokers because they burn lower-grade coals. Replacing multiple-retort underfeed stokers of another type, Iron Fireman stokers have brought this company remarkable fuel savings—over $12,000 a year. The savings have liquidated the investment in less than three years.

FUEL ECONOMY typical boiler plants



The Iron Fireman Poweram stoker (one of the many industrial models built by Iron Fireman), is designed for heavy continuous loads. It combines *worm feed* with *ram distribution* of coal. The worm conveys the coal to the retort in a loose, aerated condition; reciprocating blocks distribute it evenly and prevent packing.

GOOD COMBUSTION AND AUTOMATIC CONTROL Produce These Achievements in Iron Fireman Firing

• Good combustion, resulting from Iron Fireman firing, means fullest use of the heat units in coal, with resultant savings in fuel and increase in steam output.

Iron Fireman automatic control assures firing that is continuously balanced to steam demands. It protects against excessive feeding that wastes fuel. It guarantees adequate fire for the existing load. And it saves manpower.

The ten examples shown here are typical of Iron Fireman firing achievements.

There is an Iron Fireman for Every Industrial Firing Need

Iron Fireman stokers are available in many sizes and models to meet the most varied industrial firing requirements. Iron Fireman engineering assures you the correct stokers for *your* plant, taking into account fuel, load and operating conditions. Our nationwide organization of qualified factory representatives is at your service. Write for literature. Iron Fireman Mfg. Co., 3273 West 106th St., Cleveland 11, Ohio. Plants at Portland, Oregon; Cleveland, Ohio; Toronto, Canada.

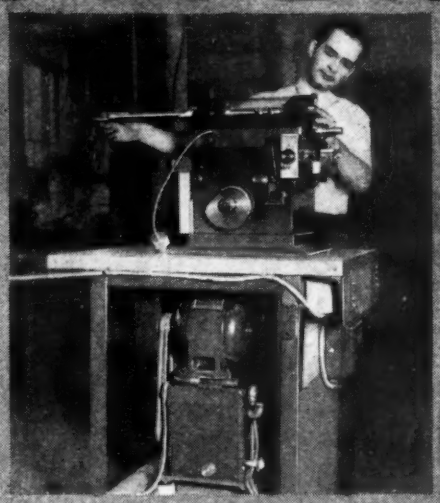
IRON FIREMAN

THE IRON FIREMAN

Automatic Coal Stokers

CAN'T QUIVER

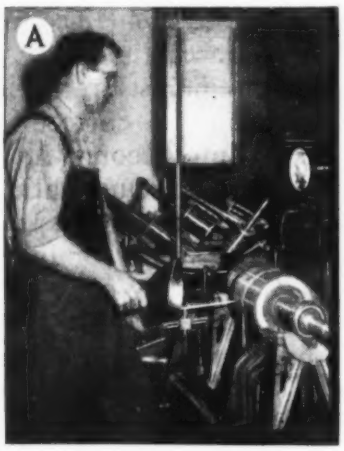
Motors driving precision machines can't quiver without affecting the work, particularly when the motor is mounted directly on the machine. The close tolerances required on so much vital war equipment have intensified the need for machines and motors that remain smooth-running, month after month, in three-shift service. Why have G-E Tri-Clad motors gone on—and stayed on—so many high-precision machines? Our test procedure for balance and vibration is an important part of the answer.

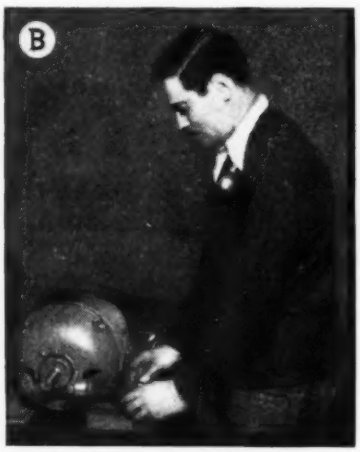


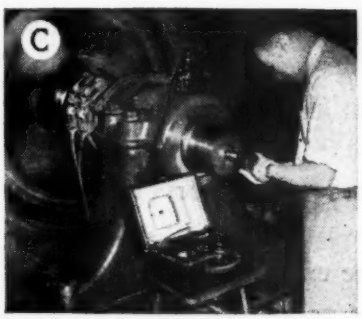
High-precision recessing machine in Waltham Watch Company plant, driven by G-E Tri-Clad motor

G.E.'s vibration tests and balancing procedure help make TRI CLAD motors smooth-running and quiet

Unmatched experience in making vibration studies, especially our work on high-speed turbines, helped us to perfect dynamic-balance techniques and devices that give assurance of smooth-running motors. Every Tri-Clad rotor is dynamically balanced, and in addition, spot-checks of assembled motors are made: (A) making an electronic dynamic-balance test on Tri-Clad rotors; (B) spot-check with G-E vibration indicator, with motors on elastic mountings; (C) portable electromagnetic tester being used on large motor. This test can also be applied to a motor installation, if desired. *General Electric Company, Schenectady 5, New York.*







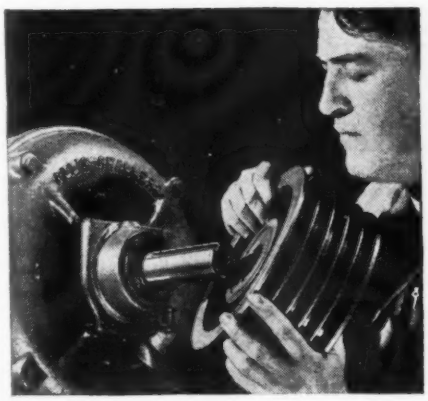
GENERAL ELECTRIC

760-245-1923

Buy all the BONDS you can—*and keep all you buy*

This locks this to this in 1 quick operation

Allis-Chalmers' new "Magic-Grip" with tapered split bushing is put on, aligned, locked to shaft *as a unit* — making it the fastest mounting and demounting sheave on the market!



1 Place sheave on shaft. Slides on smoothly because clearance is provided by expanded bushing. There's *no* hammering — *no* forcing! Complete sheave and bushing unit comes intact—ready for quick, easy mounting.

2 Slide to desired position. Sliding easily, sheave can be placed *exactly* according to straight-edge . . . giving you true alignment with resulting smooth performance. A minimum of time is required.

3 Tighten three capscrews — and it's ready to go! Entire sheave is locked securely to shaft and *grips like magic!* No set screws to damage shaft. Send for Bulletin B6310. Allis-Chalmers, Milwaukee 1, Wis.

A 1757

Allis-Chalmers Texrope "MAGIC-GRIP" SHEAVES

*Extreme

"Tycol EP Lubricants" have proved in extensive field applications their ability to more than meet the requirements of the services for which they are recommended.

Let a Tide Water engineer help you select the proper Tycol lubricant for your needs. His familiarity with Tycol's complete line of lubricants — plus his extensive experience in all phases of industrial lubrication — is your assurance of trouble-free lubrication. Call or write your nearest Tide Water office for further information.

TIDE WATER ASSOCIATED OIL COMPANY

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL • Eastern Division: 17 Battery Place, New York 4, N. Y.

Principal Branch Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

DRUMS! DRUMS! DRUMS!

War needs make it extremely important that all empty drums be returned immediately.

SCIENTIFICALLY ENGINEERED FOR EVERY INDUSTRIAL USE

TYCOL

PRESSURE (No 2)

* This is the 12th of a series of informative messages concerning the meaning and significance of commonly used tests and terms employed to describe the characteristics of lubricating oils.

TIDE WATER LUBRICANIA

DEFINITION: Extreme Pressure Lubricants are lubricants which, under certain operating conditions, permit carrying of loads greater than can be supported by mineral oils of similar viscosity.

This property of greatly increased load carrying capacity may be imparted by incorporation of suitable addition agents. The merits of EP Lubricants are defined by test and performance, rather than by chemical composition alone.

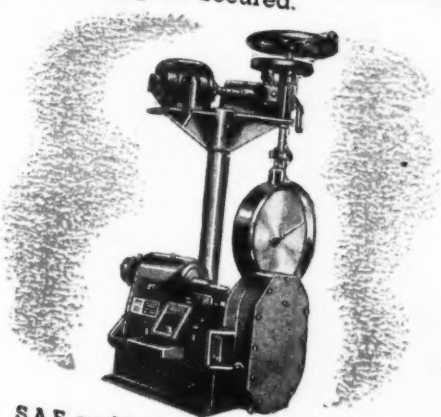
NOTE: The slight increase in load carrying ability which occurs when fatty oils are added to mineral oils is not sufficient to justify such products being termed Extreme Pressure Lubricants.

LABORATORY TEST METHODS: A number of laboratory machines are used for measuring load carrying capacity of lubricants. A series of EP Lubricants evaluated by these machines may not be rated necessarily in the same order, presumably because of differences in design and details of operation among the machines. Caution must be observed in interpreting results derived from any of these individual test methods. The degree of correlation claimed between results from laboratory measurements and those from field performance has not been positively established.

Among the more common machines employed in the laboratory to evaluate load carrying capacity of lubricants are:

The Timken Tester
The Almen Machine
The Falex Lubricant Tester
The Floyd Machine
The Four Ball Machine and
The S.A.E. Machine

At times each type of apparatus has been claimed by its proponents to be a reliable means of evaluating lubricants for a given use. No one machine is recognized generally by technologists as an exact means for predicting field performance of lubricants in all types of service. However, by using any one test machine to compare a lubricant of unknown merit with others of known service performance in a restricted field, some indication of the utility of the unknown lubricant may be secured.



S.A.E. machine for testing EP lubricants, one of many machines used for this purpose.

Gasoline Powers the Attack — Don't Waste A Drop

INDUSTRIAL TYCOL OILS-GREASES

INDUSTRIAL LUBRICANTS

★ ★ ★ **A New Pneumatic**

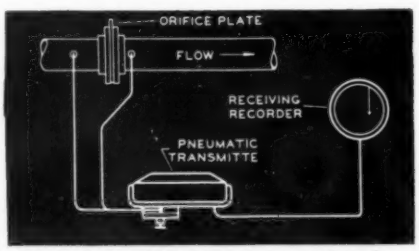
FOR MEASURING FLOW AND LEVEL

Operating on the Force-Balance Principle

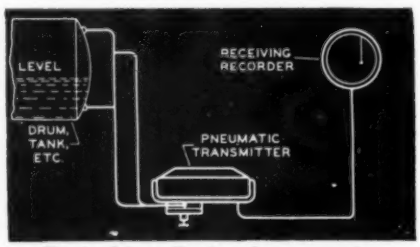
The Republic Differential Pressure Transmitter is an entirely new type of pneumatic meter which has been thoroughly field tested during the past two years. It is a simple pneumatic device for converting a differential pressure, such as is produced by the flow of a fluid through an orifice or by liquid level in a vessel, into an air pressure which varies proportionately with the differential pressure.

This air pressure is used as a direct measure of the differential pressure and can be conducted to a remote location by means of tubing. A gage or receiver connected anywhere in this transmission line will show the variations in the differential pressure and may be graduated in terms of the flow or level which it represents. The pressure can also be utilized as the impulse for actuating a controller.

The Republic Pneumatic Transmitter operates exactly like a weigh scale. The force of the differential pressure on a measuring diaphragm is the value being weighed. This force, multiplied by its lever length, is balanced by the force on a reaction diaphragm times its lever length. The pressure on the reaction diaphragm represents the weights used on a scale and is merely a means of automatically accomplishing this weighing process and transmitting the results.



Typical installation for measuring flow.



Typical installation for measuring liquid level.

RANGES—standard ranges are available from 0.9 in. to 25 in. of water differential, for working pressures up to 15 psi.; 7 in. to 50 in. of water for working pressures up to 25 psi.; and 13 in. to 800 in. of water for working pressures up to 600 psi. Special heads can be provided for working pressures up to 2000 psi.

RANGE EASILY CHANGED—the range of a Republic transmitter can be readily changed by making a few minor adjustments or substituting a few simple parts. For example, a transmitter with a differential range of 50 in. of water can be changed to any range up to 100 in. of water by merely changing the position of the reaction diaphragm.

DIAPHRAGM MATERIAL—diaphragms for the Republic transmitter can be made from practically any material including rubber, synthetic rubber, Saran, brass, stainless steel, Monel, silver, etc. This is possible due to the extremely small motion required. (.010 in. for full scale reading). The material is specified in accordance with the solvent or corrosive action of the measured fluid.

●

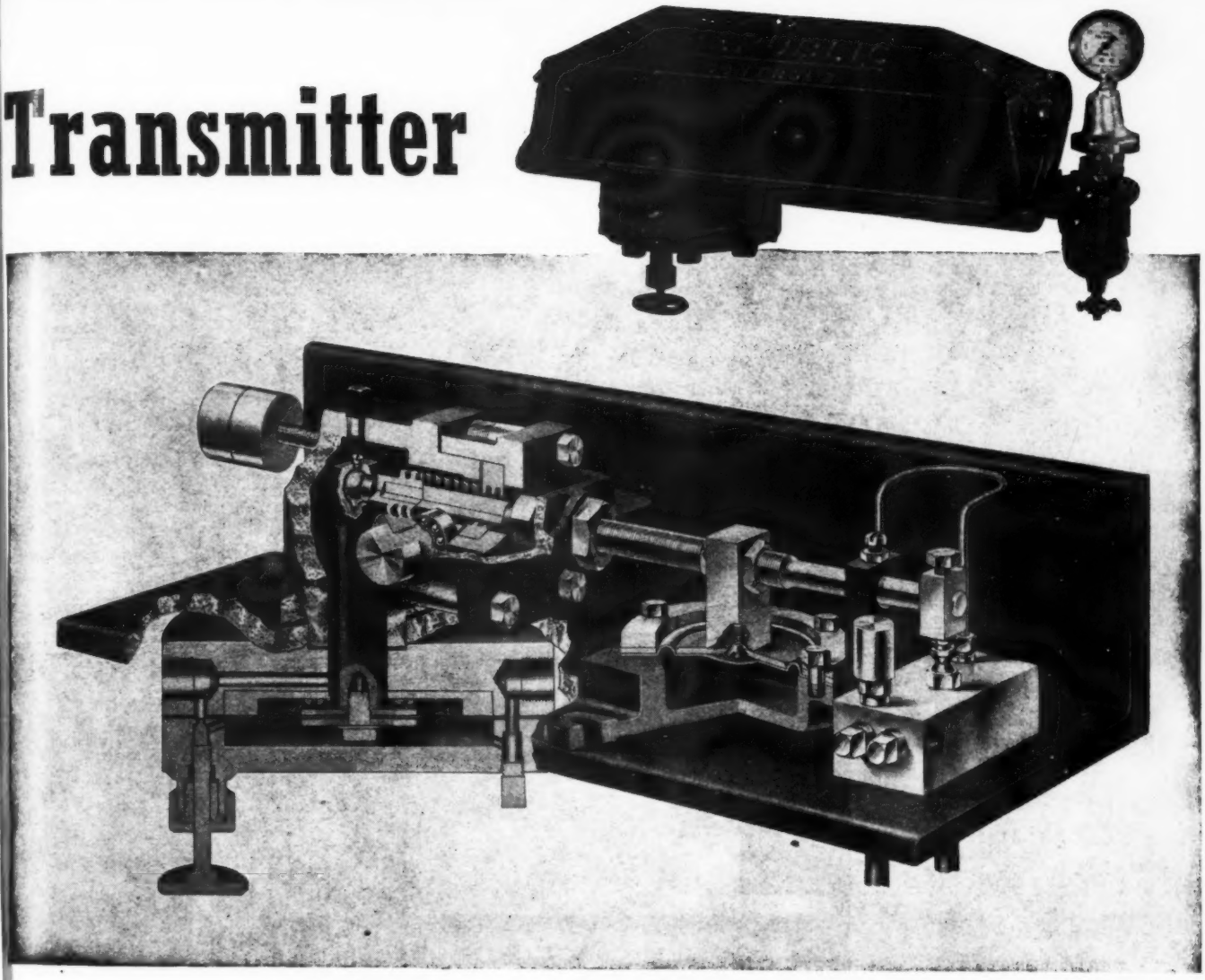
For complete details write for Bulletin No. 43-4

REPUBLIC INSTRUMENTS AND CONTROLS

REPUBLIC

2222 DIVERSE

Transmitter



Exterior and cut-away view of the Republic Pneumatic Transmitter.

PERFORMANCE FEATURES

ACCURACY of the Republic force-balance method of measurement is higher than can be consistently secured and maintained with any other method. Transmitting pressure vs measured differential is guaranteed within ½ of 1% of meter range.

SENSITIVITY — due to the negligible motions required for complete operation of all parts for full scale change, no appreciable hysteresis results from reversal of direction of measurement change. The hysteresis loop is so small that it is undetectable by ordinary means, being less than 1/20 of 1%.

RESPONSIVENESS — due to the fact that there is virtually no volume displacement, the Republic Pneumatic Transmitter is able to follow flow changes almost instantaneously. The time required to produce full output pressure at the transmitter is in the nature of fractions of a second, after the differential is imposed. Therefore a receiving instrument installed adjacent to the transmitter will show flow changes almost instantly. With 500 feet of ¼ in. O. D. tubing, the full value of the change will have registered on a Republic receiver in 15 seconds. This is the overall lag in the system not merely the transmission lag.

NO TEMPERATURE EFFECT — the effect of ambient temperature variations on the accuracy of a Republic transmitter is negligible. Since all parts are equally affected by temperature changes, force and leverage relationships are not disturbed and accuracy is unimpaired.

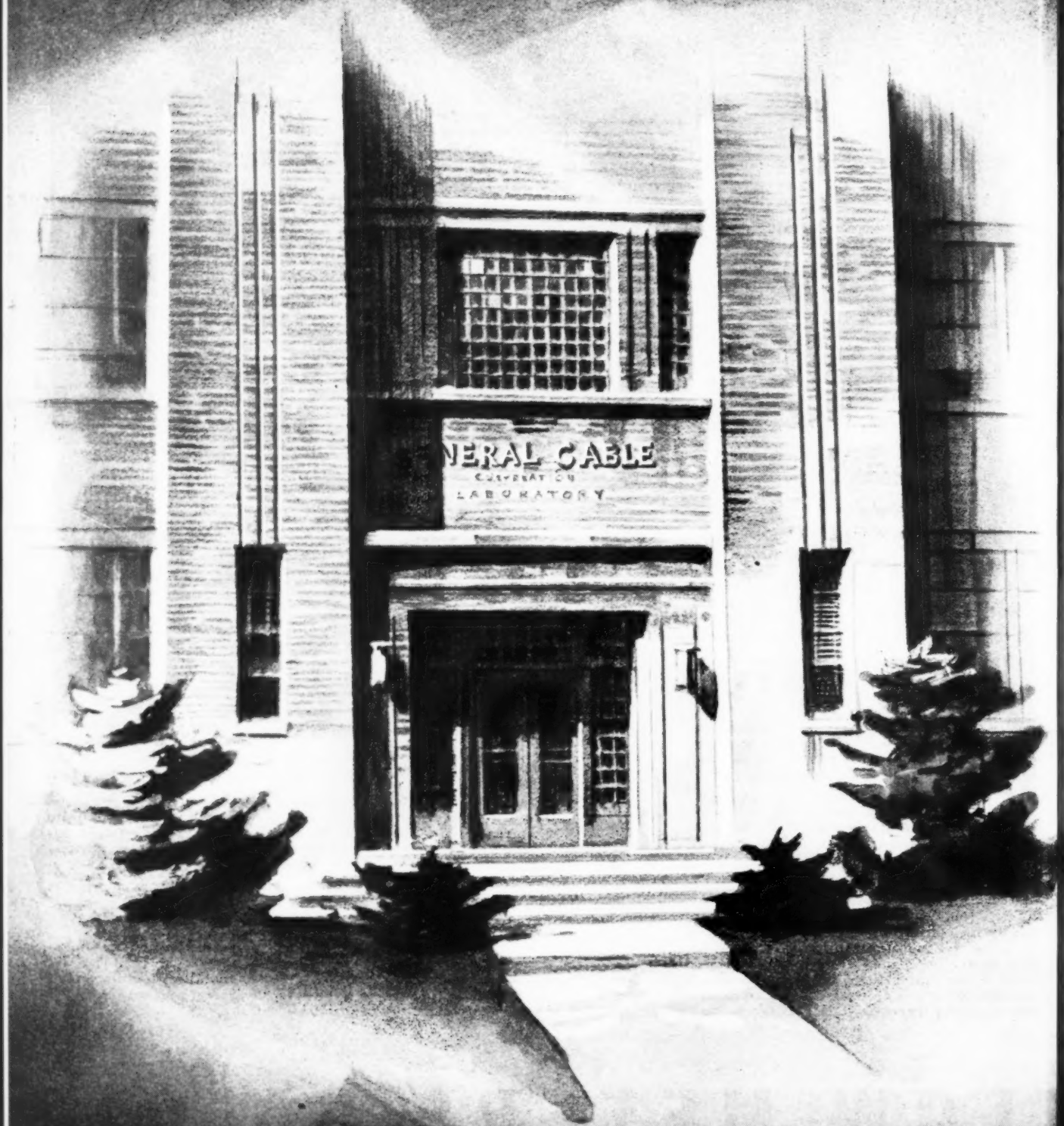
NO VIBRATION EFFECT — the Republic transmitter is unaffected by any normal frequency of vibration ordinarily encountered in industrial or process plants.

AIR CONSUMPTION — the air consumption of the pneumatic system is .20 cfm. maximum at 20 psi. supply pressure, when differential is zero. At maximum differential consumption is zero and is inversely proportionate to intermediate, differentials.

FLOW METERS CO.

PARKWAY • CHICAGO • ILLINOIS

RESEARCH...SPEARHEAD



The 80 practical specialists who work in this magnificent building at Bayonne, N. J., have every facility—chemical, physical, metallurgical—to aid them in bringing nearer their goal—extending to the utmost the effective means of electrical transmission and distribution. Built in 1941, the structure has already grown to 60,000 sq. ft. of floor space—is planned for further expansion as needed.

OF ALL PROGRESS...

THE FIRST GREAT LABORATORY DEVOTED EXCLUSIVELY TO RESEARCH ON ELECTRICAL WIRES AND CABLES

. . . thus "basic research in a particular industry devolves naturally upon the leading manufacturer." General Cable has been alert to its responsibility. In this great Laboratory are maturing the insulation discoveries and product developments which will loom large in days ahead.

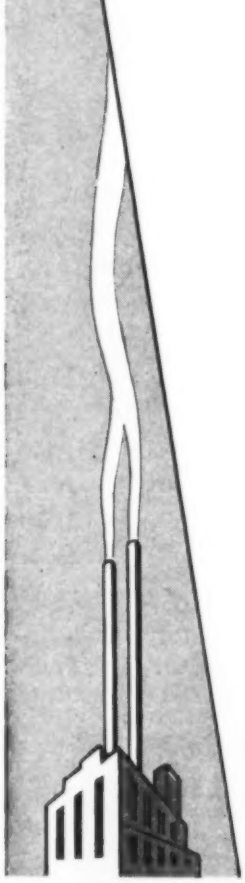
GENERAL CABLE CORPORATION

Manufacturers of Bare and Insulated Wires and Cables for Every Electrical Purpose

Here's *Essential data*

SUBJECT: **Remote reading water level indicators for safety, lower cost operation, and efficient supervision**

ITEM: **Reliance EYE-HYE Remote Reading Gage**



Panel board controls are so well established in power plant practice that you wouldn't think of omitting these essential factors from new plans or modernization figures. The one item most lacking at control stations has been close-at-hand vizual water level indication—although Reliance EYE-HYE is in its eighth year of existence and numbers thousands of boilers in its record of satisfying installations.

• The convenience of reading your water levels in the EYE-HYE, alongside other instruments, works wonders in boiler operating efficiency. EYE-HYE's numerous applications with its unusual flexibility of placement, puts it high on the list of supporting equipment in your planning file.

• Whether panel-mounted or elsewhere, EYE-HYE's easily-understood simplicity and sturdy, dependable construction guarantees constant accuracy of water level indication. Its distinctive green indicating fluid, brilliantly illuminated, is constant reassurance to the engineer on duty.

• These check-lists give you a condensed description of what EYE-HYE does and where it can be profitably used. *Write for Bulletin 382-C and any special information you think you'll require to complete this important section of your planning file.*

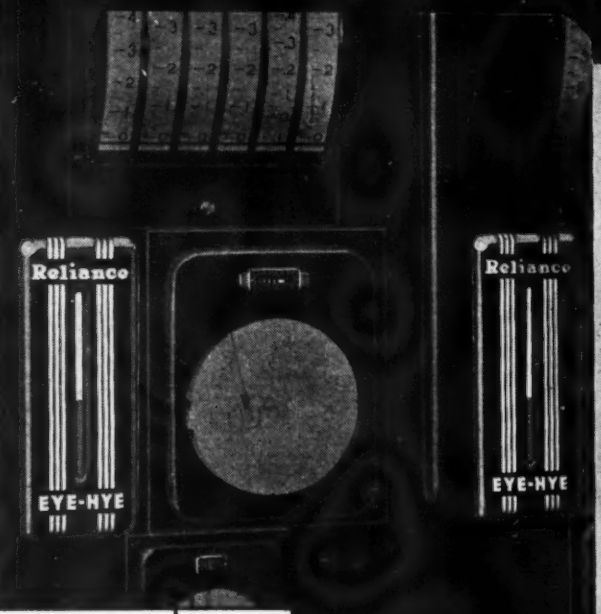
60 Years of Boiler Protection

1884-1944

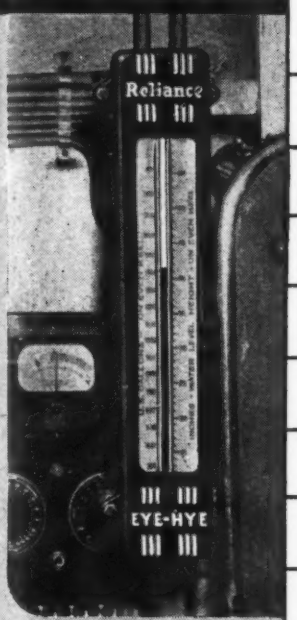
Reliance

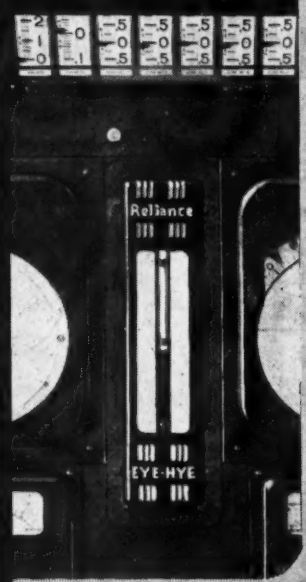
for your Power Plant Planning file

What you should expect in a Remote Reading Water Level Indicator	Reliance EYE-HYE
Flexibility of placement. Gage reading *precisely where* most convenient to use.	✓
Scientific accuracy. U tube manometer principle for laboratory exactness.	✓
Sharp visibility. Eye-appealing green indicating fluid, illuminated.	✓
Simplicity. Smooth hydrostatic action — no mechanical working parts.	✓
Safety. Invites frequent reading — an aid to preventing accidents.	✓
Easy installation. Flexible tubes from boiler to gage window.	✓
Low maintenance. Scheduled cleaning only at infrequent intervals.	✓



Where remote reading gages promote efficient operation & safety	Reliance EYE-HYE
Stationary power boilers	✓
Marine power boilers	✓
Waste heat boilers	✓
Heating boilers	✓
Mercury vapor boilers	✓
Feed water heater tanks	✓
Storage tanks	✓
Surge tanks	✓

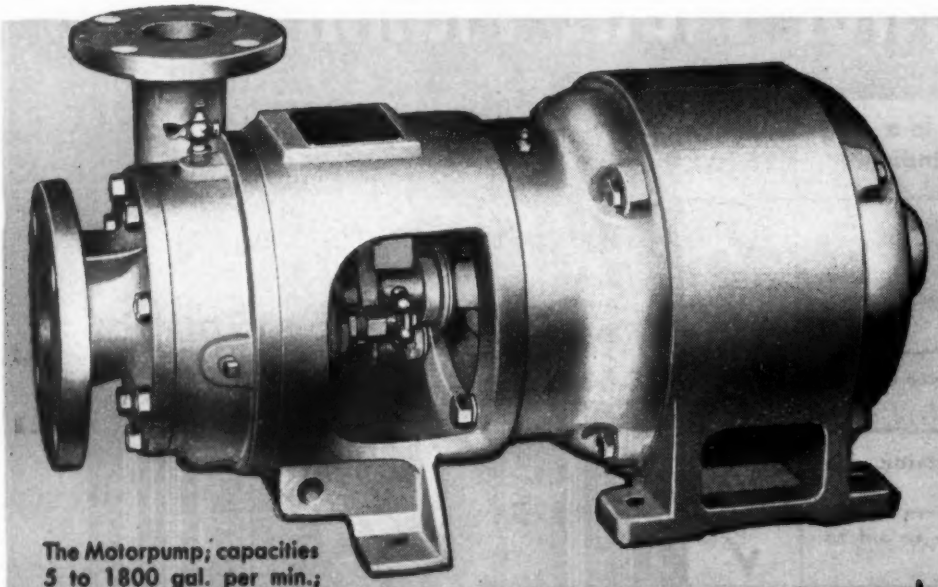




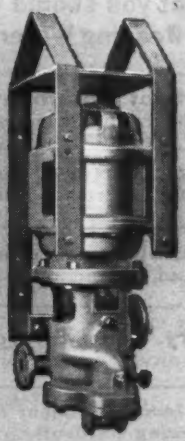
BOILER SAFETY DEVICES

THE RELIANCE GAUGE COLUMN CO.
5902 Carnegie Ave., Cleveland 3, Ohio

THE MOTOR PUMP IS MANY PUMPS



The Motorpump; capacities 5 to 1800 gal. per min.; heads to 500 ft.



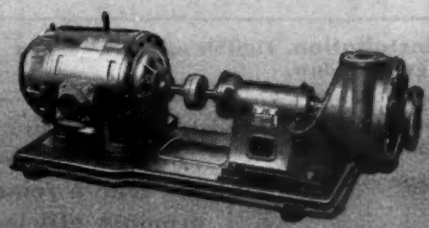
Sling-yoke mounting for mine-shaft or contracting work.

..one of them will fit your job

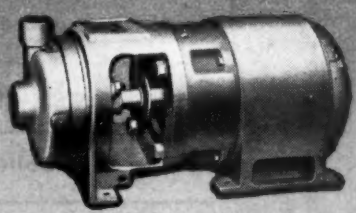
Motorpumps are highly efficient, compact and sturdy pumps. There are sizes small enough to be held in the hand and others to handle as much as 1800 gal per minute. The basic unit has a built-in electric motor. However, various modifications such as built-in steam turbine, cradle mounting for any type of drive, sling-yoke mounting for mine or contracting work and many other mountings and special parts provide pumps tailored to your specific needs. Ingersoll-Rand Company, Cameron Pump Division, 11 Broadway, New York 4, N. Y.

Ingersoll-Rand

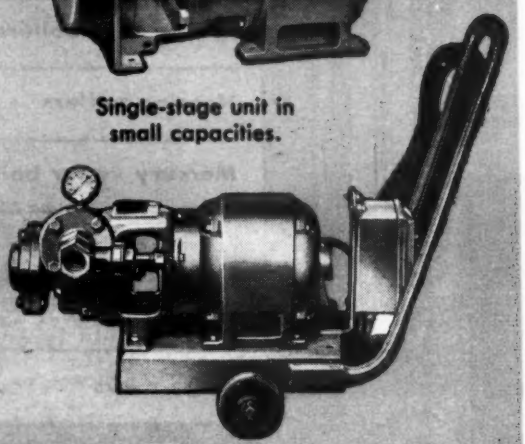
9-401



Cradle mounting, class CRV.



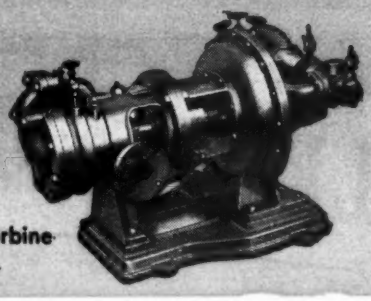
Single-stage unit in small capacities.



Portable mounting.

Condensate-return unit.

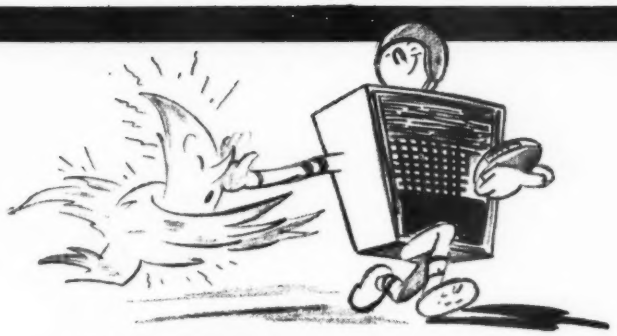
Ask the I-R Service Engineer for Further Details



Close-coupled turbine driven unit.

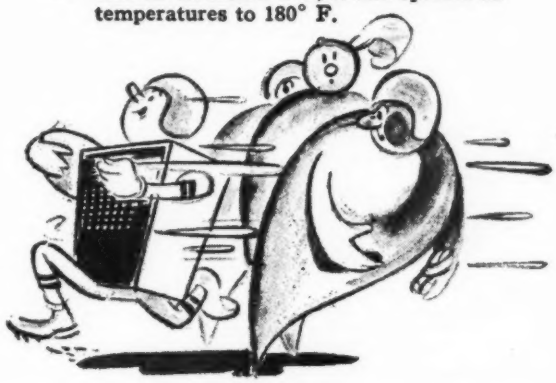
HERE'S ALLIS-CHALMERS' GREAT NEW V-Belt Team!

ALLIS-CHALMERS recommendations for belt selections are unbiased . . . because Texrope's V-belt lineup is *complete.* And as inventor of the multiple V-belt drive, A-C offers sound engineering help . . . backed by the world's longest experience in giving industry money-saving drives.



1 **HEAT-RESISTING SUPER-7** has ability to withstand high ambient built right into it. Standard belt, it can operate in temperatures to 180° F.

2 **OIL-RESISTING SUPER-7** is right for drives where fairly bad oil conditions prevail. Neoprene-covered, it resists oil spray and grease.



3 **OIL-PROOF SUPER-7,** is solid Neoprene—a synthetic unaffected by most rubber attacking liquids. Recommended for ***extreme*** oil conditions.

4 **STATIC-RESISTING SUPER-7** *conducts* static charge to machine for grounding charge. This safety belt is applied where explosion danger exists.

5 **SUPER-7-STEEL** employs endless steel cables to provide greater strength, reduce belt stretch. It is ideal for driving extra-heavy loads.

A 1732

IT PAYS TO MAKE ALLIS-CHALMERS YOUR V-BELT DRIVE HEADQUARTERS

Texrope Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

Then he said to himself

"A War Measure of First-Class Magnitude"

WHEN the standing of India was occupying the attention of Washington, Mohandas Karamchand Gandhi wrote to the India League of America:

> "I want you to look upon the immediate recognition of India's independence as a war measure of first-class magnitude."

For a man so definitely non-Hollywood in dress or words "FIRST-CLASS MAGNITUDE" amounts to a cataclysmic pronunciamento.

Again it shows that one who is fired by a great idea automatically adds emphasis to enthusiasm! And *that* is an important business measure.

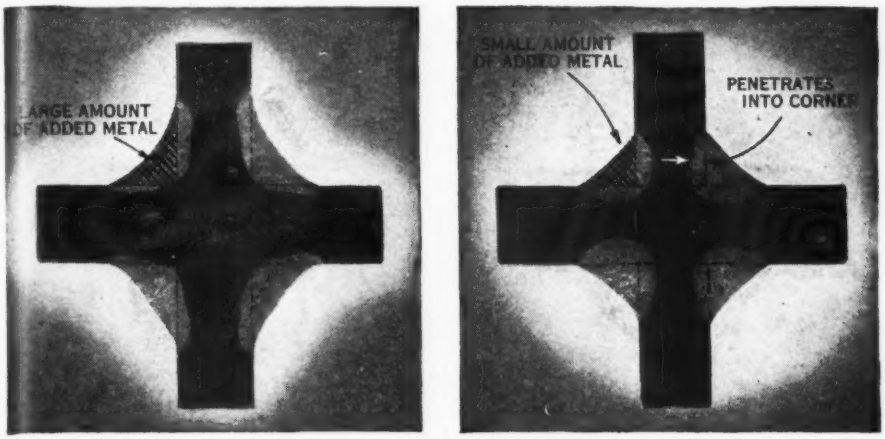
You saw it well illustrated when war conversion was hurled at manufacturers . . . and when "impossible" schedules were handed them.

Men were far from enthusiastic. Remember?

But viewed in the light of subsequent experience, those quotas for air, land and sea weapons today seem modest. All because aroused men quickly found out first-hand what Arc Welding could do. And when it did the job well, they became enthusiastic . . . which brings triumph to any front.

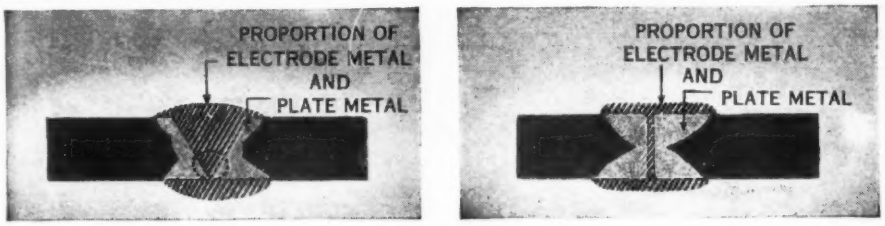
"A War Measure of First-Class Magnitude"...he says

CONVENTIONAL WELDING | **"FLEET-WELDING"**



TYPICAL FILLET WELDS

STRENGTH:	**Stronger than plate**	**STRENGTH:**	**Stronger than plate**
SPEED:	**5" per min.**	**SPEED:**	**12" per min.**
COST:	**100%**	**COST:**	**42%**



TYPICAL BUTT WELDS

STRENGTH:	**Stronger than plate**	**STRENGTH:**	**Stronger than plate**
SPEED:	**2" per min.**	**SPEED:**	**9" per min.**
COST:	**100%**	**COST:**	**25%**

LOOK, MAHATMA: While you pondered on the magnitude of political measures for winning, Lincoln Engineers were enthusiastically working out a very practical measure that is away out in front in magnitude:

"FLEET-WELDING"

A First-Class Production Measure ... of First-Class Magnitude

This new, revolutionary technique using "ARC-FORCE" to speed the welding of all types of joints in plate, shapes and sheet is bringing back reports of 25% to 75% faster welding . . . also savings in electrode material and power. Cases also are reported where back-chipping and plate beveling are eliminated.

The savings shown at left are typical of this new technique developed by Lincoln engineers.

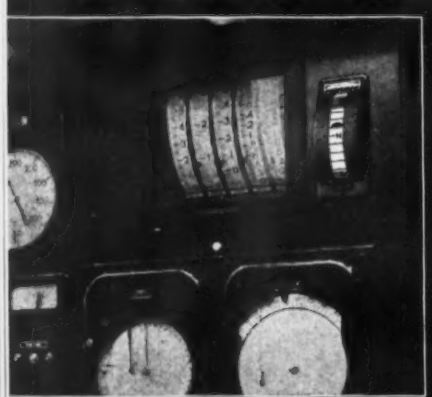
A Lincoln engineer is available nearby to help you apply "Fleet-Welding" Technique. Write for Bulletin No. 440 which gives complete explanation of the simple technique and the welding procedures.

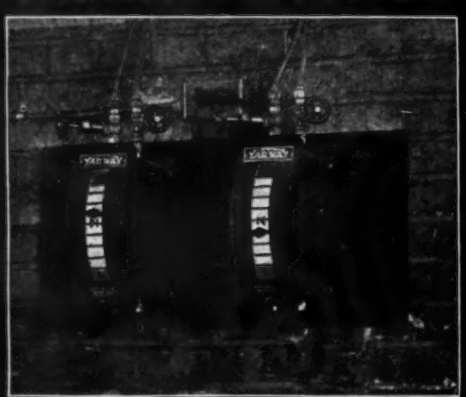
THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

NEWS! A Water Level Indicator

2

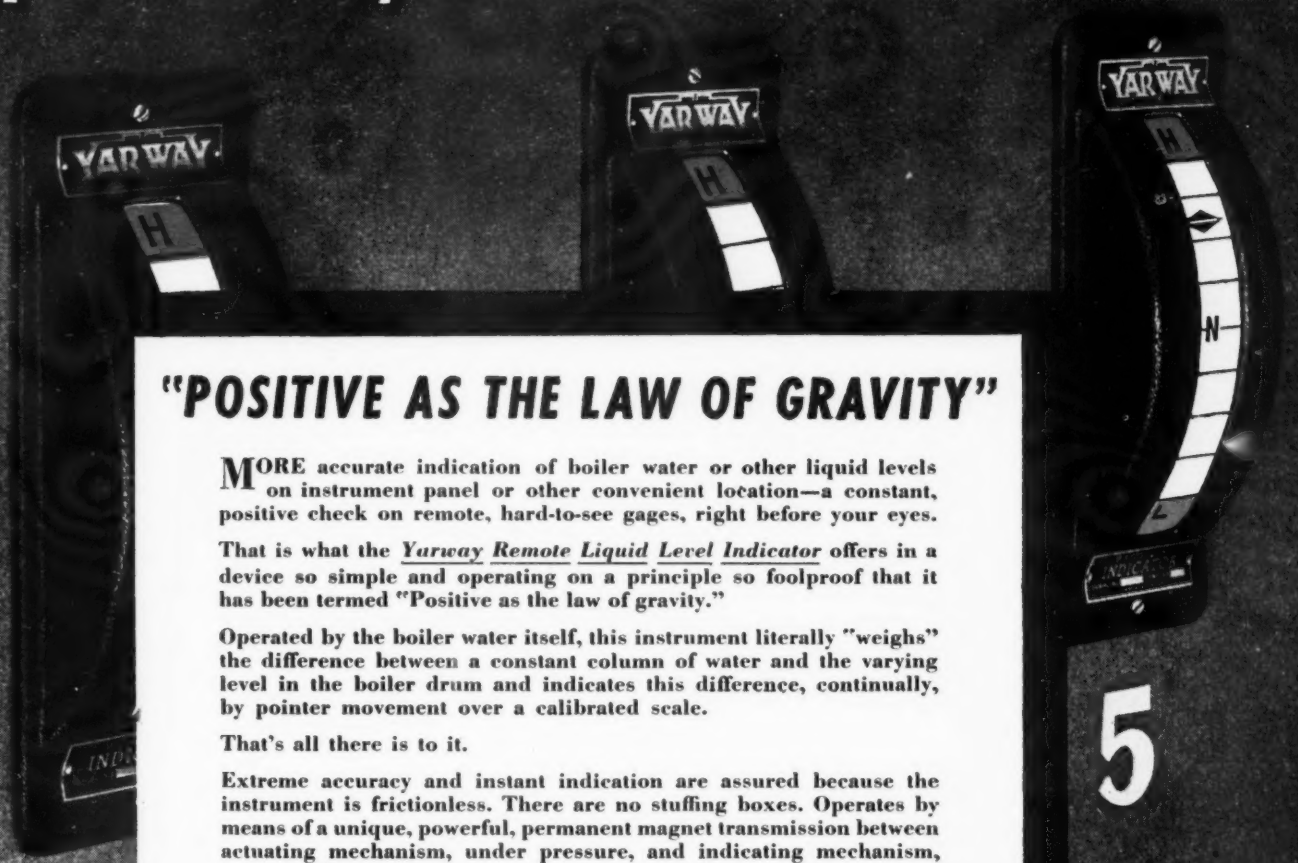
A FEW OF THE HUNDREDS OF YARWAY REMOTE LIQUID





YARWAY

Operated by the Boiler Water Itself



"POSITIVE AS THE LAW OF GRAVITY"

MORE accurate indication of boiler water or other liquid levels on instrument panel or other convenient location—a constant, positive check on remote, hard-to-see gages, right before your eyes.

That is what the *Yarway Remote Liquid Level Indicator* offers in a device so simple and operating on a principle so foolproof that it has been termed "Positive as the law of gravity."

Operated by the boiler water itself, this instrument literally "weighs" the difference between a constant column of water and the varying level in the boiler drum and indicates this difference, continually, by pointer movement over a calibrated scale.

That's all there is to it.

Extreme accuracy and instant indication are assured because the instrument is frictionless. There are no stuffing boxes. Operates by means of a unique, powerful, permanent magnet transmission between actuating mechanism, under pressure, and indicating mechanism, at atmosphere.

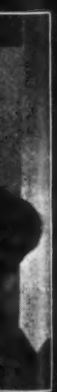
Hundreds of Yarway Remote Liquid Level Indicators in service throughout Industry and the Yarway Steam Laboratory's own accelerated endurance test (duplicating over 50 years of normal boiler service) have proved the dependability of this instrument beyond question.

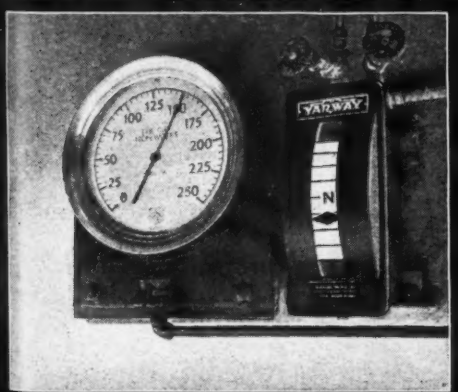
Satisfied that it more than meets exacting Yarway Standards, this instrument is now offered to the general public. Look into this *moderately priced* instrument which is easily installed on new or existing boilers and is suitable for all pressures up to 1500 lbs.

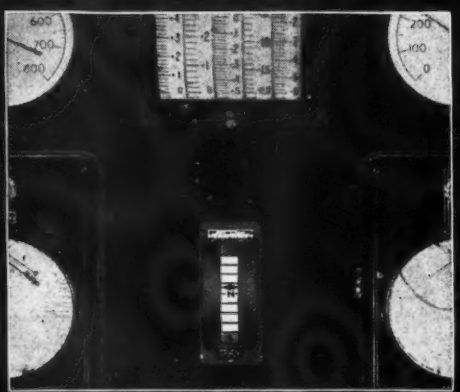
Write for Bulletin WG-1820.

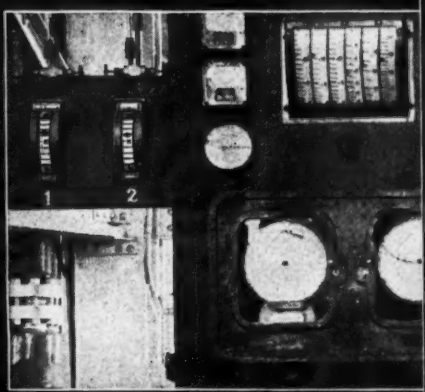
YARNALL-WARING COMPANY
100 Mermaid Ave., Phila. 18, Pa.

UID LEVEL INDICATORS IN STATIONARY AND MARINE SERVICE









REMOTE LIQUID LEVEL INDICATOR

COMPASS

on its record, today's best buy in transmission belting

◆

● The famous Goodyear Compass Cord transmission belt — now made with oil-resisting synthetic rubber — has an added margin of superiority over other belt constructions.

The Compass belt, for sixteen years, has been first choice on the toughest mill drives. Its patented, balanced cord carcass carries the load — and the cords are built to the same prewar quality standard. The rubberized fabric envelope protects the cords from wear, and here Goodyear uses the best oil-and-abrasion-resistant synthetic rubber.

You know what Compass has done — its records are legion in every industry. Today's synthetic rubber Compass belt benefits from Goodyear's twenty years' experience in improving synthetic rubber. The G. T. M. — Goodyear Technical Man — will be glad to recommend the proper Compass for your drives. Just write Goodyear, Akron 16, Ohio, or Los Angeles 54, California — or phone the nearest Goodyear Industrial Rubber Goods Distributor.

Compass—T. M. The Goodyear Tire & Rubber Company

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

GTM-Specified

COMPASS CORD TRANSMISSION BELT for oil well service

BALANCED BODY made of heavy rope-cord spiralled continuously without a splice. Cord on opposing sides of belt axis is twisted in opposite directions to neutralize torque of cord.

BALANCED COVER laid parallel to axis of belt — made of fabric in which alternate warp threads are twisted in opposite directions to prevent side-creep.

A PRODUCT OF GOODYEAR RESEARCH

GOODYEAR

THE GREATEST NAME IN RUBBER

★ BUY WAR BONDS—BUY FOR KEEPS ★

A SOLID STRUCTURE such as a motor shaft rarely fails from the inside out—it fails from the outside in. Moral: get rid of every surface tool mark or irregularity that might someday invite cleavage.

That's what Stan Brothers, above, of Allis-Chalmers Norwood Works is doing. As he painstakingly polishes the shaft—back and forth, back and forth—he works down to a finish that's slicker than silk.

Why does he follow his job so intently? Because in 17 years at Allis-Chalmers Stan has learned that he and every other employe has a *personal* stake in every motor.

He knows that when he helps build a *great* motor for you he helps make a *friend* . . . and that friends are something no company and its workers can have too many of.

Actually, it was friends that put Allis-Chalmers importantly in the motor business in the first place.

Years ago, Allis-Chalmers began building motors only because it wanted, to put on heavy-duty equipment it built, better motors than it could buy. Then a few of those motors were sold separately to one customer, a few to others . . .

And the reputation those motors earned—"You can depend on Allis-Chalmers Motors"—literally forced Allis-Chalmers into building electric motors in volume for the market!

So the very existence of Norwood Works is proof and reminder to every Allis-Chalmers coil winder, machinist, inspector, welder, brazer, painter, assembler—that *good work catches up with a company just as surely as bad work.*

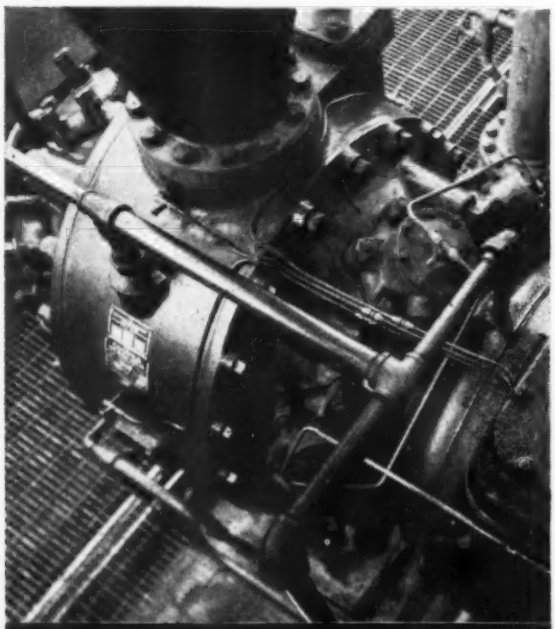
That's why you can expect *good* work in every Allis-Chalmers motor! Allis-Chalmers, Milwaukee 1, Wis.

A 1728

YOU CAN DEPEND ON ALLIS-CHALMERS MOTORS

A BIG STEP FORWARD

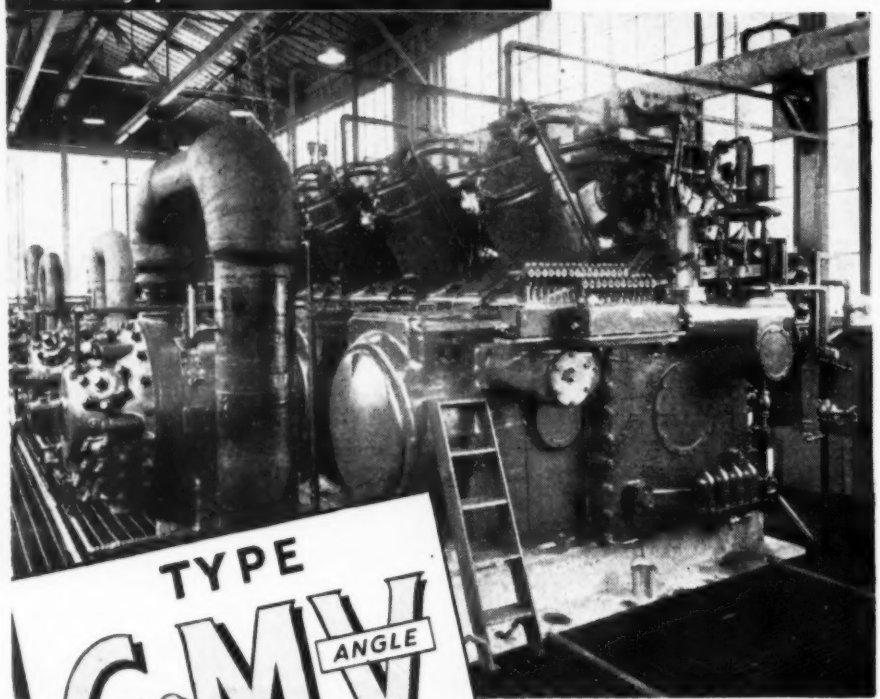
Every stage of unloading



Top view of one G-MV compressor cylinder showing pneumatic suction valve lifters.

COOPER-BESSEMER engineers have perfected a unique system that insures smooth compressor performance through full volume range. It will help any plant — chemical, refinery or other process industry — where compressors are called on to maintain extremely accurate, uniform pressures or flow rates under widely fluctuating loads.

Cooper-Bessemer has pioneered in control techniques as applied to compressors — control of pressures, flow rates, torque, etc. Now, a simple, reliable method has been developed to interpose speed control between the successive steps of unloading* to give a straight-line control over approximately 100% demand. This new method of smoothly and accurately matching compressor capacity to process demand extends the advantages of speed control far below the limits previously practical with automatic control.



View of the complete automatically controlled unit — in this case an 800 hp G-MV in the gas liquefaction plant of the East Ohio Gas Co., Cleveland, Ohio.

TYPE G-MV ANGLE Compressors

New York Washington Bradford, Pa. Parkersburg, W. Va. San Francisco, Cal. Seattle, Wash.

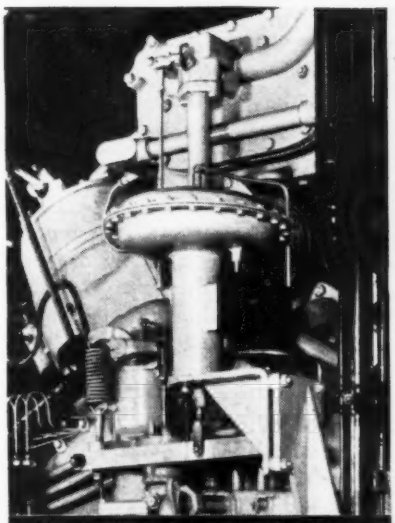
IN AUTOMATIC CONTROL

is speed controlled!*

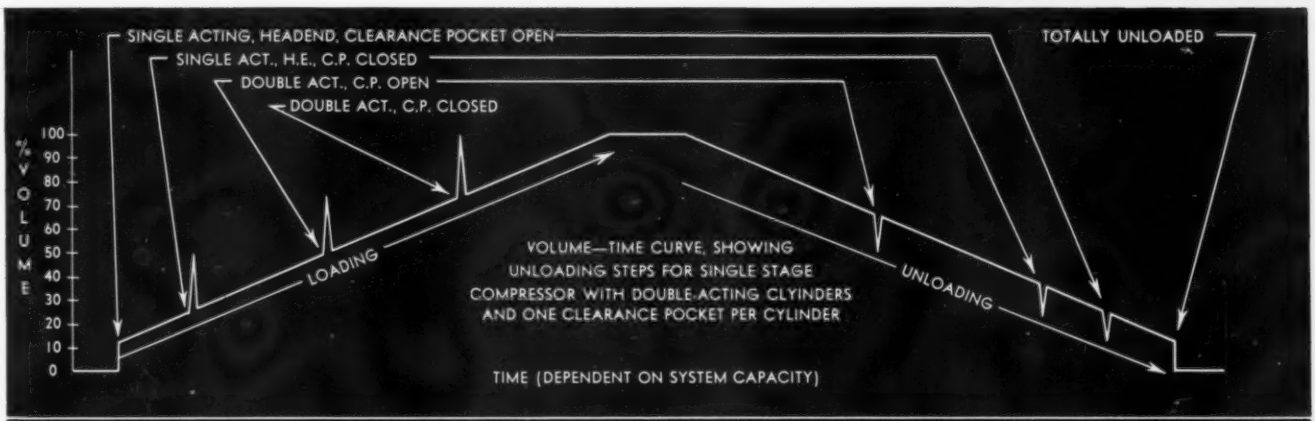
In the graph chart below, the volume-time curve and speed-time curve show how unloading combines with speed control to produce straight-line performance.

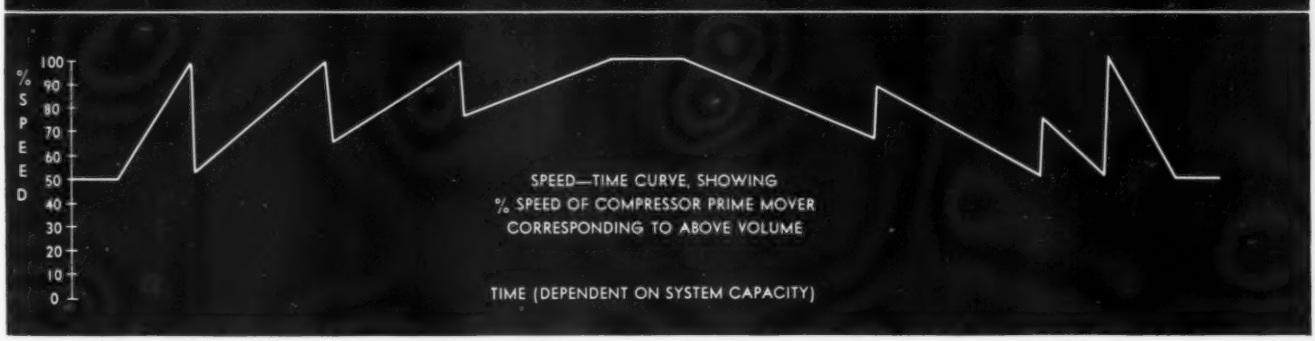
This new-type control is now available for all sizes of Type G-MV compressors. It does not require elaborate or expensively different equipment. If you have a control problem, drop us a line. Our representative will be glad to arrange for installation of this new Cooper-Bessemer control system when you order your new G-MV compressors.

*Patent Applied for.



Above: close-up showing diaphragm regulated governor for speed control of G-MV compressor—a key part of the new combined speed-control-unloading system.





by **Cooper-Bessemer**

MOUNT VERNON, OHIO AND GROVE CITY, PENNA.

Houston, Dallas, Greggton, Pampa and Odessa, Texas Tulsa Shreveport St. Louis Los Angeles

American Blower

A constantly increasing list of industrials has turned to American Blower to solve their dust problems. Many of these firms have been using American Blower equipment with highly satisfactory results for more than 20 years. Today, we are building dust collecting equipment for war industries of many types. Tomorrow, after Victory, our facilities will be available for all industries who recognize that dust collection is only sound business. If you have operations involving mining, brushing, drying, grinding, crushing, packing, dumping, conveying, spraying, cleaning, tumbling or rattling, or, if cinders, ash or fly-ash present a problem, contact our nearest branch office or write direct to the factory and we will keep you posted on progress on our Dust Collectors. Our engineering staff and laboratory facilities, the finest in the industry, are available to you for testing dust samples of all types.

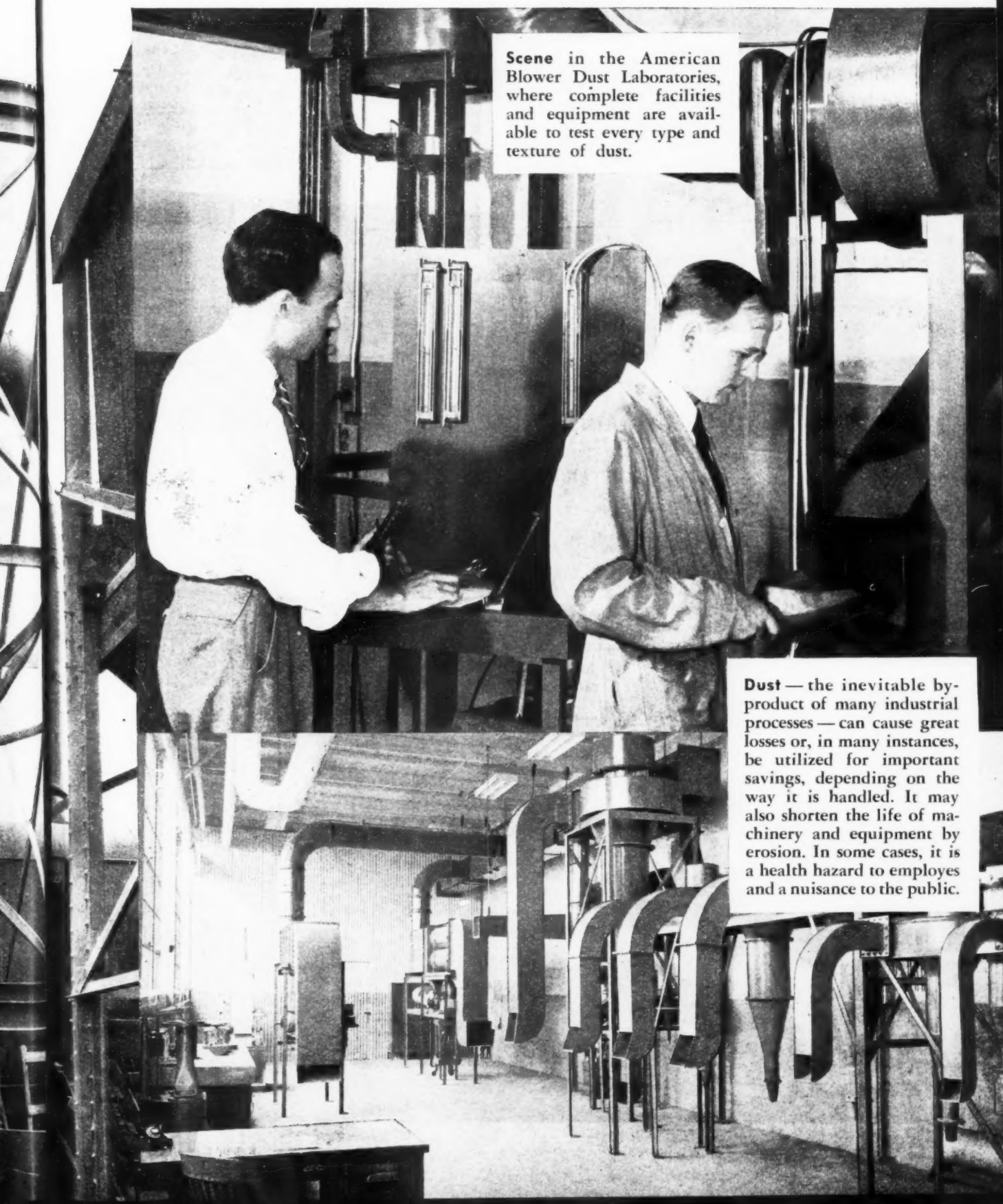
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.

Division of American Radiator & Standard Sanitary Corporation

These are typical installations of American Blower Dust Collectors which have been in operation many years.

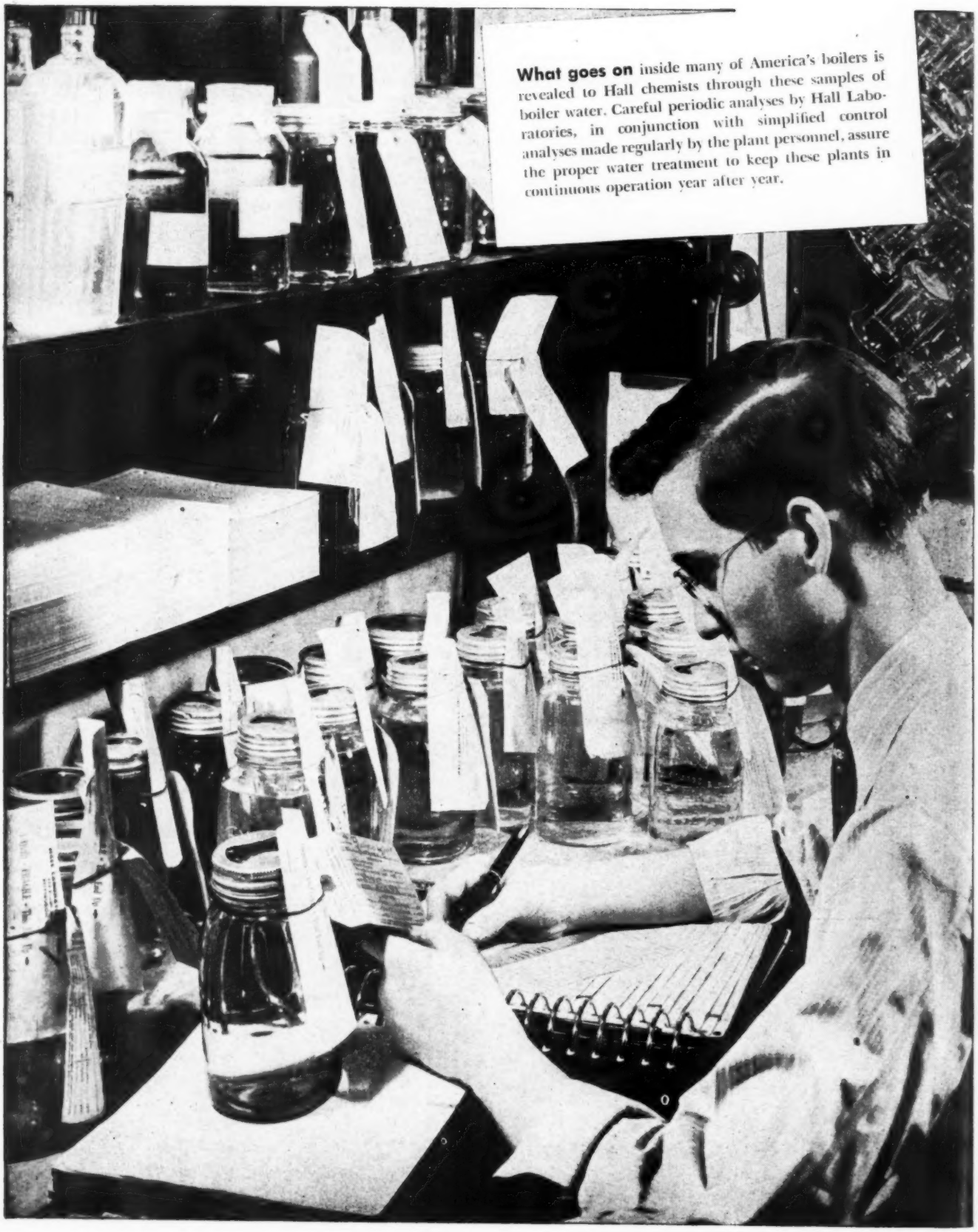
DUST COLLECTORS



Scene in the American Blower Dust Laboratories, where complete facilities and equipment are available to test every type and texture of dust.

Dust — the inevitable by-product of many industrial processes — can cause great losses or, in many instances, be utilized for important savings, depending on the way it is handled. It may also shorten the life of machinery and equipment by erosion. In some cases, it is a health hazard to employes and a nuisance to the public.

Why successful



What goes on inside many of America's boilers is revealed to Hall chemists through these samples of boiler water. Careful periodic analyses by Hall Laboratories, in conjunction with simplified control analyses made regularly by the plant personnel, assure the proper water treatment to keep these plants in continuous operation year after year.

boiler operation is an "inside job!"

PROGRESS began in water conditioning service when a group of Hall chemists started the research into what goes on *inside* a boiler. At that time power plant operators were at the mercy of scale, corrosion, carryover and embrittlement.

To this simple, and now clearly obvious approach to the problems of boiler water conditioning, which Hall Laboratories follow as vigorously today as they did twenty years ago, the entire steam power world is indebted. One by one the mysteries surrounding the effects of steam under high pressures and high temperatures have been solved. On learning the causes the road was cleared for finding the remedies.

Out of this knowledge and experience has come the best system ever devised for keeping a boiler out of trouble arising from water—THE HALL SYSTEM OF PREVENTIVE CARE. Operated within your own plant, by your own personnel under direct Hall field supervision, it effectively eliminates unscheduled outages which owe their origin to scale, corrosion, embrittlement and carryover.

Today, in many of the country's leading power plants, Hall preventive care is as much a part of their operating system as the very boilers in which it is employed. The reason is plain. It brings results. They have the comforting assurance that behind it is the world's most authoritative source for the solution of water conditioning problems.

You can probably remember the time when the only clean boiler was a new one. Today, through Hall preventive care, countless veteran boilers are contributing mightily to war production. May we give you further facts about this service?

HALL LABORATORIES, INC., Hagan Building, Pittsburgh 30, Pa.
A Subsidiary of Hagan Corporation

Water samples are accurately checked to see that oil content is being kept to an absolute minimum.

HAGAN
HALL
BUROMIN
CALGON

HALL SYSTEM of Boiler Water Conditioning

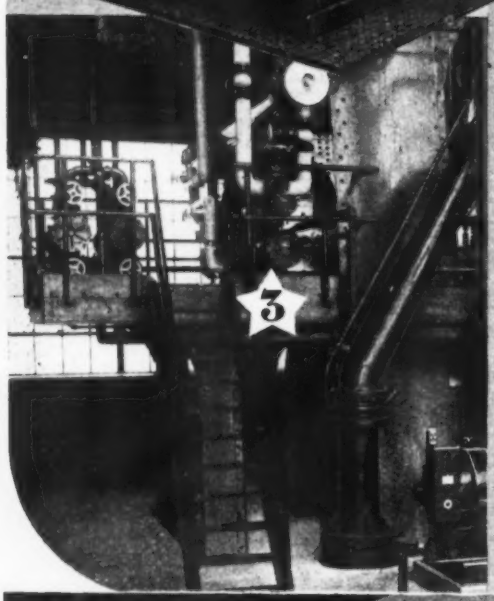
Hall Service in a Nutshell

At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning. In addition, with your full cooperation, Hall Service:

1. Minimizes boiler outages caused by water
2. Helps maintain highest efficiency.
3. Establishes non-embrittling water
4. Minimizes carryover.
5. Prevents corrosion in boilers and associated equipment.
6. Prevents deposition in water lines and cooling systems.

To Avoid Fire Hazard

ISOLATE OIL FROM HIGH-TEMPERATURE STEAM



IN this De Laval multistage turbine power is transmitted mechanically to the valve-lifting gear 1 at the top of the casing from a pilot-controlled hydraulic cylinder in the sub-base, 2 which also encloses the speed governor, accumulator and relief valve, and other parts relating to the governor control.

The main reservoir for both lubricating and hydraulic pressure oil, the main and auxiliary oil pumps, the strainers, and the oil coolers are located on a platform 3 below the sub-base.

No oil cylinders or oil piping are over the steam chest or the steam piping, thus keeping oil away from high-temperature steam.

Other requirements of high-pressure, high-temperature steam have been met by the use of special alloys and improved design throughout.

Ask for Publication T-3527

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS and COMPRESSORS • IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY · TRENTON 2, NEW JERSEY

SALES OFFICES: ATLANTA • BOSTON • CHARLOTTE • CHICAGO • CLEVELAND • DENVER DETROIT • DULUTH • EDMONTON • GREAT FALLS • HAVANA • HELENA • HOUSTON KANSAS CITY • LOS ANGELES • MONTREAL NEW ORLEANS • NEW YORK • PHILADELPHIA PITTSBURGH • ROCHESTER • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE TORONTO • TULSA • VANCOUVER • WASHINGTON, D. C. • WINNIPEG

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A CROSS-INDEX OF SUBJECTS FOR THE MONTH

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STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

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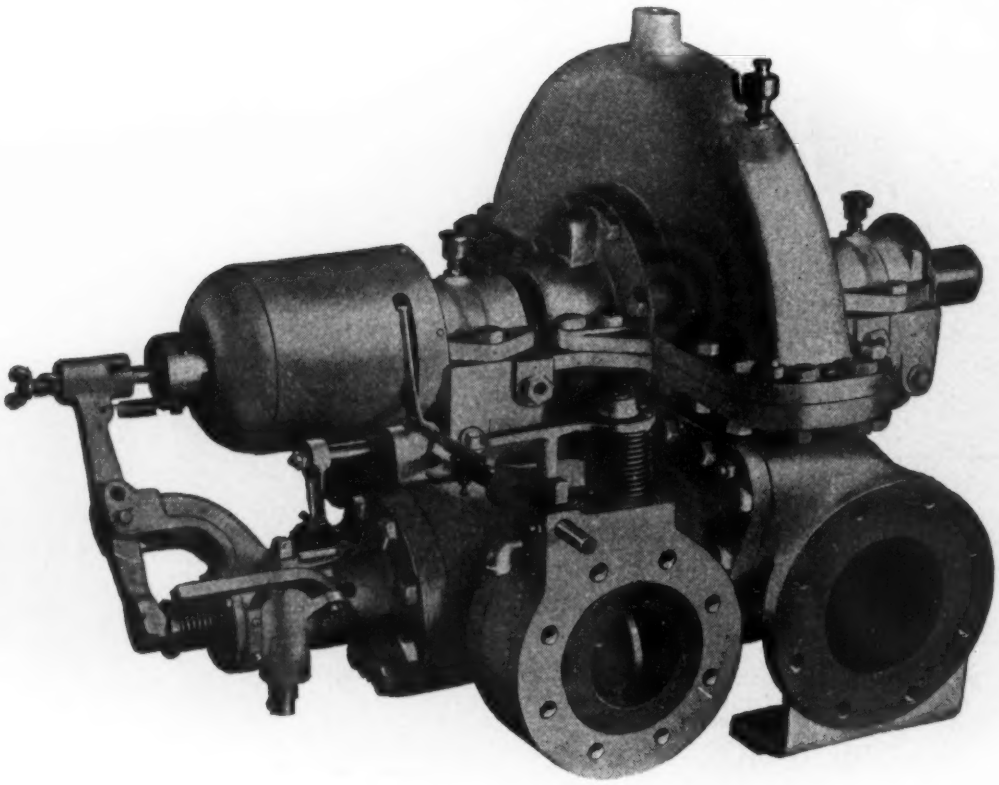
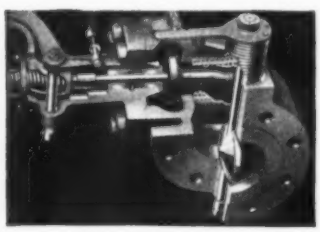
THE TURBINE WITH

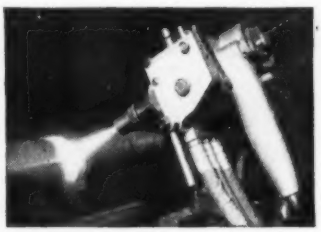


Steam turbines are expected to perform—and do, in all probability—for longer periods, with less attention than any other type of power drive. To meet these severe service demands, Westinghouse offers a complete line of Type C General Purpose Turbines with "built-in protection" against overspeed . . . steam leakage . . . explosion . . . unbalance.

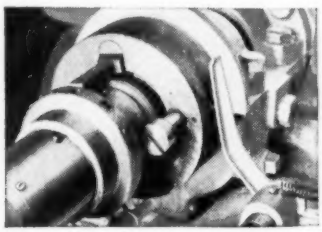
Built-in protection is typical of the plus features of Westinghouse General Purpose Turbines . . . features that result in extra reliability, extra safety, extra economy in operation. Competent engineering help in application problems and a nationwide maintenance service are as near as your telephone. Westinghouse Electric & Mfg. Co., Box 868, Pittsburgh 30, Pa.



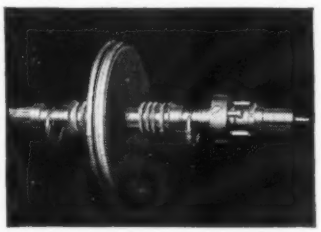
DUAL PROTECTION—During normal operation the turbine speed is controlled by the centrifugal-weight governor, or a regulator. If for any reason this control should fail, the overspeed trip device takes charge—simultaneously closing the butterfly valve and the governor valve when speed reaches 10 per cent above normal.



SHAFT PROTECTION—to prevent steam leakage and consequent oil contamination resulting from rust-cut carbon gland segments, shaft is sprayed with a generous thickness of high chrome-nickel steel at the two gland zones. Shaft is grooved, undercut and knurled to provide a permanent anchor for the sprayed metal. After spraying, entire shaft is finish-ground.



EXPLOSION PROTECTION—The only possible place a spark can occur in a turbine is on the overspeed trip lever. In applications where the turbine must operate in an explosive atmosphere, a sparkless overspeed trip lever with an insert of a special Westinghouse-developed plastic, Micarta, is used.



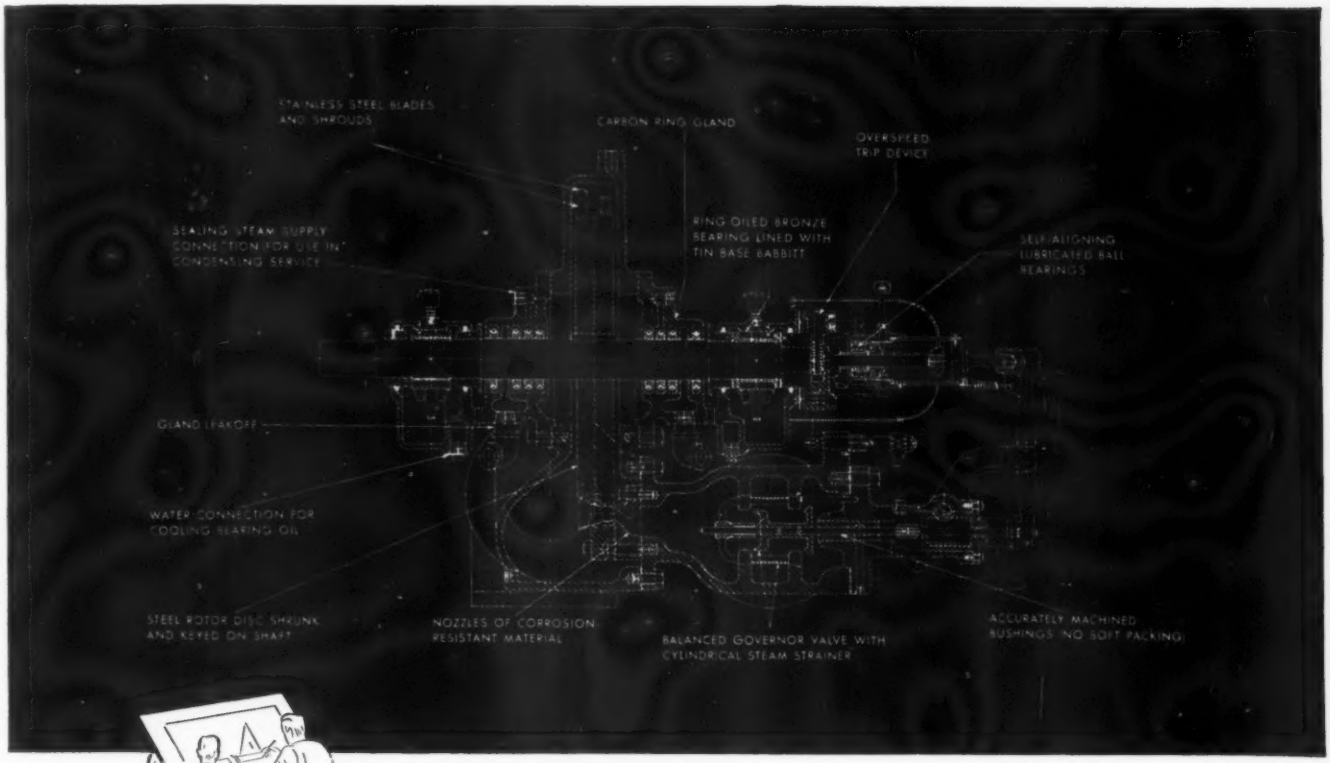
ROTOR PROTECTION—to sustain smooth operation, the rotor must preserve its original shape and dynamic balance in service. Placed in balance on the Westinghouse-developed Dynetric machine, the rotor is then coated with corrosion-resistant paint which insures maintenance of original shape and balance. Particularly important for stand-by or intermittent operation.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Steam Headquarters

Built-in PROTECTION


STAINLESS STEEL BLADES AND SHROUDS
CARBON RING GLAND
OVERSPEED TRIP DEVICE
SEALING STEAM SUPPLY CONNECTION FOR USE IN CONDENSING SERVICE
RING OILED BRONZE BEARING LINED WITH TIN BASE BABBITT
SELF-ALIGNING LUBRICATED BALL BEARINGS
GLAND LEAKOFF
WATER CONNECTION FOR COOLING BEARING OIL
STEEL ROTOR DISC SHRUNK AND KEYED ON SHAFT
NOZZLES OF CORROSION RESISTANT MATERIAL
BALANCED GOVERNOR VALVE WITH CYLINDRICAL STEAM STRAINER
ACCURATELY MACHINED BUSHINGS (NO SOFT PACKING)

DESIGN FEATURES

EASY TO INSPECT . . . by removing cover of horizontally split casing. All pipe connections are made to lower half of casing.

NO SOFT PACKING . . . for valve stems. Nickel-iron bushings have sufficient clearance for free movement of valve stems. Each stem has intermediate leak-off . . . minimizes leakage of steam into engine room. Governor valve and cage, butterfly valve and valve stems are highly resistant to corrosion and erosion.

CORROSION AND EROSION-RESISTANT NOZZLES . . . maintain proportions permanently. Passages are accurately drilled and reamed on a special machine that holds proportions precisely to design specifications—insures highest nozzle efficiency.

POSITIVE LUBRICATION . . . assured by ring-oiled bronze bearings lined with tin-base babbitt. Either bearing may be removed by unbolting bearing cover.

EFFICIENT CARBON GLANDS . . . held around the shaft by stainless steel garter springs, control steam leakage at points where the rotor shaft extends through the casing. A leak-off at each gland minimizes leakage past the outer ring.

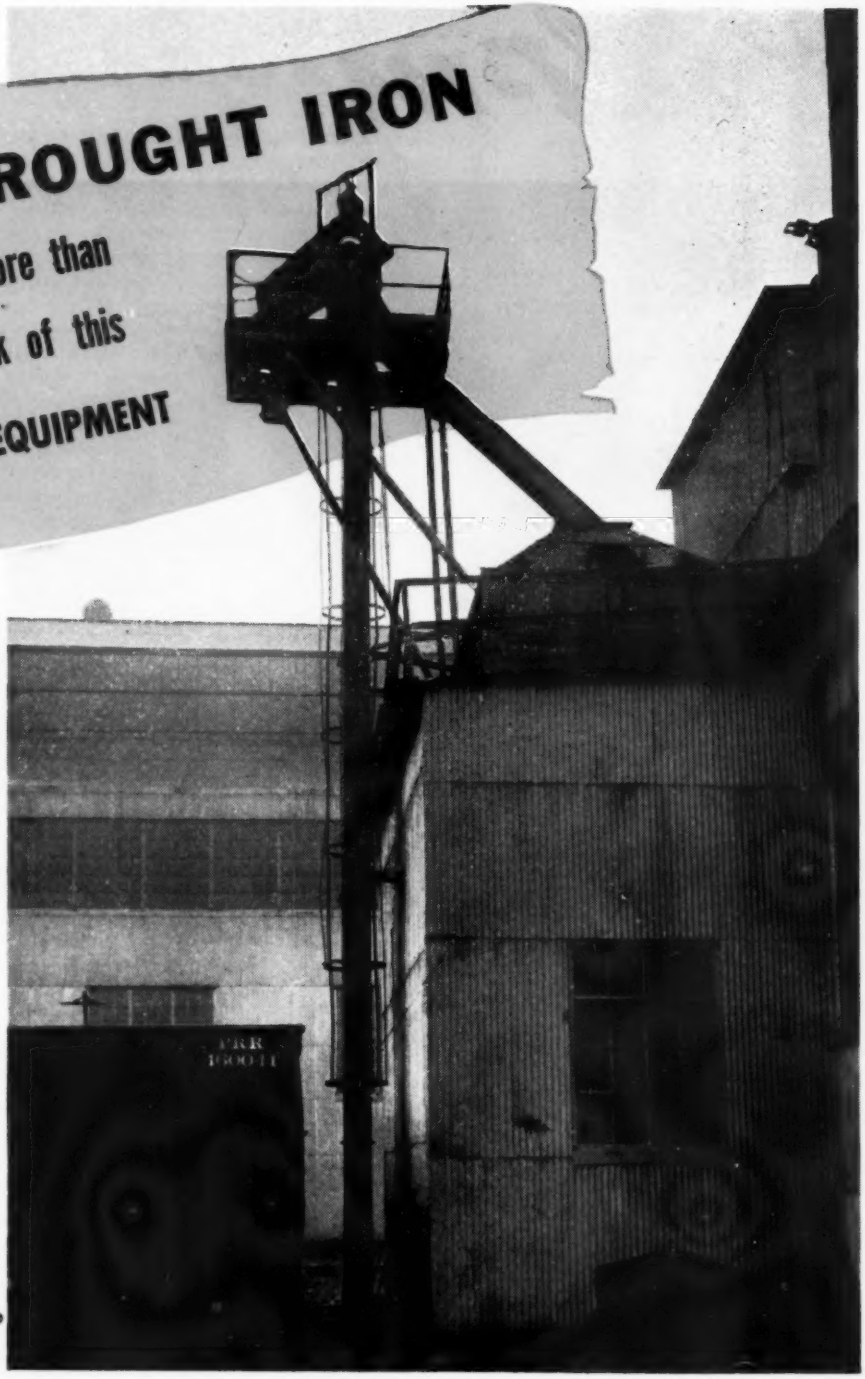
EACH TURBINE FACTORY TESTED . . . by a running trial with steam for adjusting governor, setting overspeed trip, checking smoothness of operation, testing glands and steam joints. J-50447

Steam Headquarters **Westinghouse**

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

BYERS WROUGHT IRON

doubled the life and more than tripled the useful work of this COAL CONVEYING EQUIPMENT



Here's an engineer's report that every man concerned with the maintenance of coal handling equipment can read with profit. It concerns the casing on a Redler Elevator, originally made of ordinary low first-cost 10-gauge material, and ultimately rebuilt with wrought iron.

—June, 1935 . . . Redler first put into operation.

—December, 1936 . . . small holes first appeared in casing.

—December, 1936 to October, 1938 . . . casing maintained by considerable patching. Deterioration during this period increased at rapid rate, and maintenance was excessive. Estimated useful life of first conveyor casing extended from June, 1935 to January, 1937.

—Coal conveyed during period—14,658 tons.

—October 1, 1938 . . . new casing of ¼-in. wrought iron installed.

—November, 1943 . . . inspection indicated that the partition wall between the two compartments had worn through in various spots. During this entire period, not a nickel had been spent for repairs. Since repairing the partition wall would have required a shutdown while the Redler was dismantled, a new casing was ordered.

—Coal conveyed up to end of 1943—88,651 tons.

Adjusting for the greater (56%) thickness of the wrought iron, *equivalent* service was obtained after it had been installed 29.65 months, and handled 22,866 tons of coal. Its actual useful life was twice as long and the useful work done was 3.8 times as great.

It is not every day, of course, that such complete comparative figures can be obtained, but the fact that wrought iron can generally be expected to give much longer relative service has been common knowledge to hundreds of engineers—as is shown by its widespread use for coaling stations, bins, hoppers, bunkers, chutes, spouts, conveyors, and larry cars.

You'll find some helpful information on reducing maintenance in coal handling equipment in our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment." Want a copy?

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

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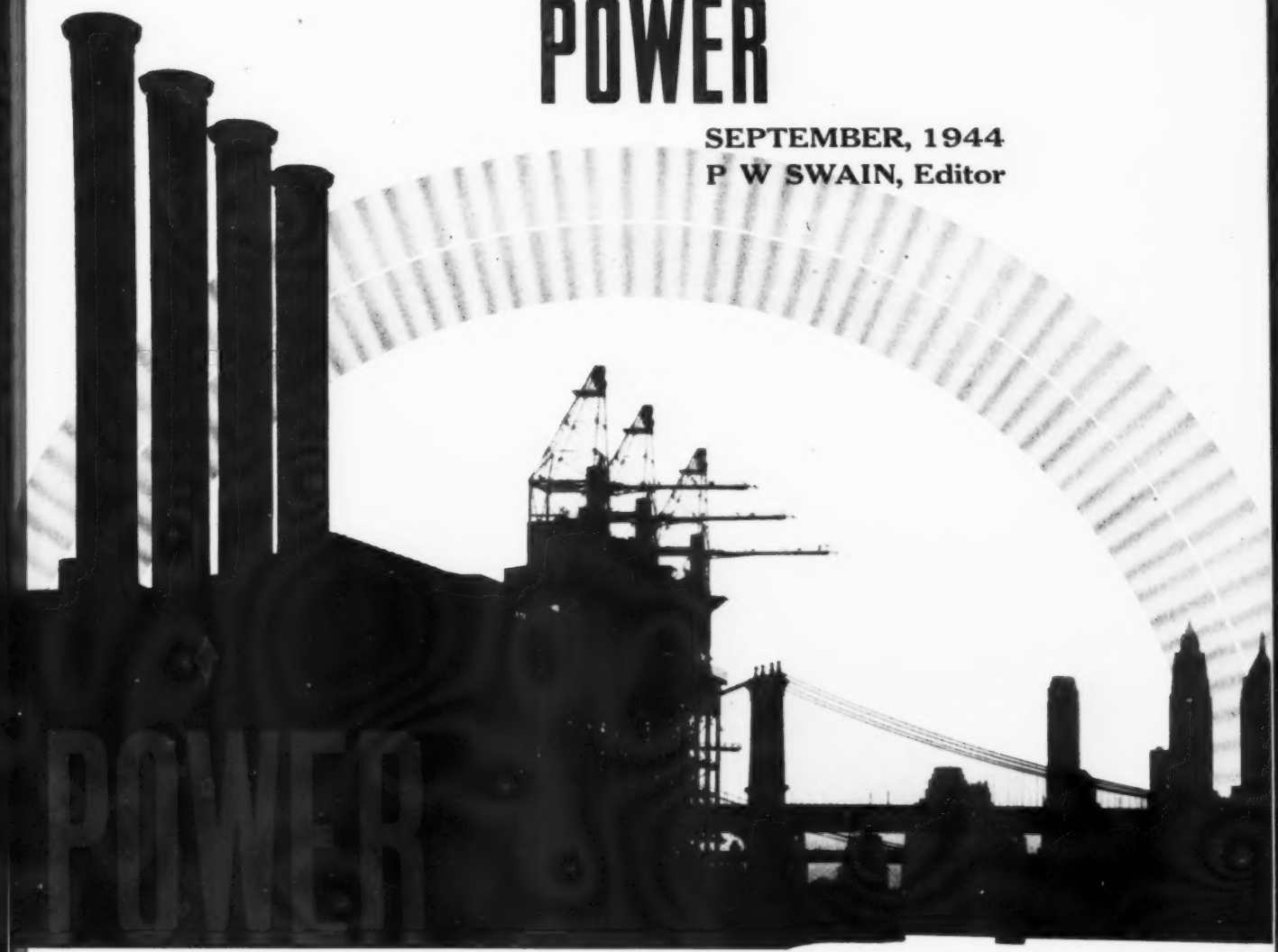
GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

POWER

SEPTEMBER, 1944
P W SWAIN, Editor



FOR PEACE

A guide to the power plans that must be made now to insure prompt reconversion

By S A TUCKER and L N ROWLEY

According to military men this nation is still a long way from the luxury of free buying and selling or even from starting to remodel civilian industry. But we would not be doing our job if we did not point out forcefully that the time *has arrived* for earnest and detailed planning of reliable and efficient power services for peacetime industry.

The fact that power men in industrial and utility plants can take pride in smooth functioning of equipment under difficult conditions is in great part due to early planning for war by a healthy industry. The same kind of forward thinking is needed now to bridge the gap between war and peace.

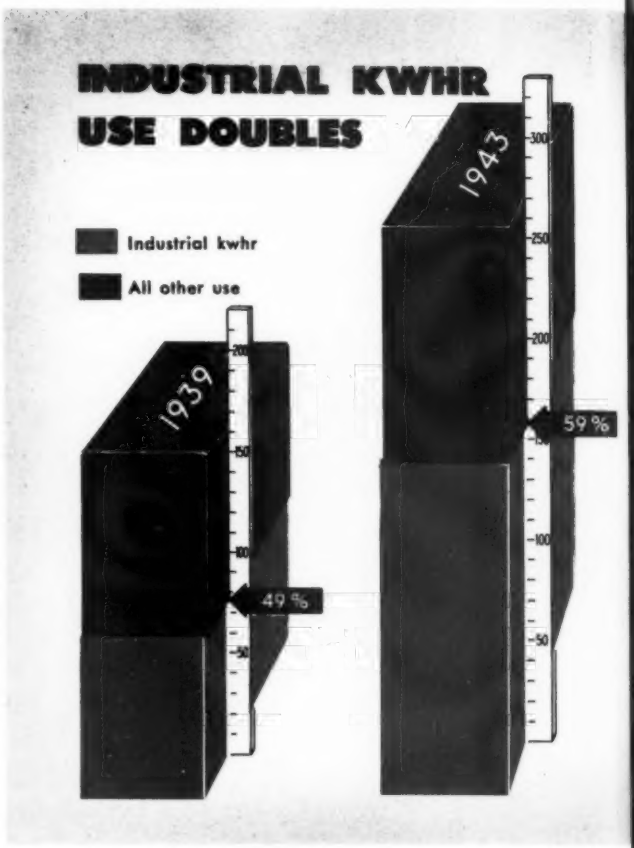
Soon most of the tough problems of converting manufacturing plants to war use will begin to appear in reverse. A bit here and a bit there, in no clear pattern, manpower, materials and equipment will become available. The engineer ready with step-by-step plans for modernization and construction will be in position to act promptly, speeding the reconversion of his own facilities and of industry.

Properly drawn, such plans will not only facilitate action in the readjustment period but will insure eventual development of fully integrated power services, having the high efficiency that will be needed in a competitive postwar world.

To guide this planning, POWER here summarizes some of the lessons learned in war years, outlines problems of the near future, and suggests matters for consideration in long-term planning.

POWER Did Not Fail

That power has never been too little or too late is a source of satisfaction, but now margins of safety are thin, equipment is shaky and maintenance skill is everywhere lacking. Reconversions must be planned



At one time or another almost every basic requirement of the production front has run short, except power. This has been the case despite the fact that original estimates of need for new generating capacity were geared to a much smaller war program than has actually been accomplished.

In September 1941 POWER published a table showing the Federal Power Commission's estimate of new capacity needed to meet the then established war program. This totaled more than 13 million kw for steam central stations alone and somewhat less than half as much more of hydro power to be installed in 1941-1946 inclusive.

Because land-turbine production interfered directly with construction of Navy and Maritime Commission ship-propulsion units, a courageous War Production Board cut 5 million kw of proposed new generating units out of the program, reducing new installations to a bare minimum. This was admittedly a restriction of the public power supply to a critical if not dangerous level.

However, immediate steps were taken to (1) extend greatly existing power pools by maximum use of interconnections (2) reduce peak loads by year-round establishment of war time and (3) provide for interconnection of industrial plants.

The pooling operation was credited by J A Krug, then Director of Office of War Utilities, with assuring the equivalent of 1¼ million kw of additional firm power. War time, according to Edward Falck, present Director of OWU, has reduced peaks by 1½ million kw and incidentally saved 1½ billion kwhr per year, equivalent to at least a million tons of coal a year. Interconnection of industrials, which would have required an appreciable amount of new materials and labor, has not been necessary.

CONSERVATION of electric power, fuel, gas and water was planned and carried out on a voluntary basis. Later a specific "brownout" of daytime advertising lighting and curtailment of non-essential lighting except for limited evening hours was enforced. Regulations were soon relaxed, however, and the average citizen is now asked only not to waste electricity because it represents manpower in the mines.

Present program of the National Fuel Emergency Council set up by the Solid Fuels Administration aims largely at small and medium-size industrial and commercial consumers of fuel principally in the interest of reducing "waste" of coal and, secondarily, oil. One result of this effort is to make available, without red tape, controls and related equipment for commercial and industrial heating installations where a fuel saving can be expected.

Best indication that power generating capacity has not been short in any part of the country is the release of one of four 30,000-kw floating power plants for foreign service. Some further relief of the burden on fuel-fired plants has been afforded by shutting down some of the emergency aluminum plants now that supplies of that metal are adequate.

UTILITIES, including government, municipal and other plants contributing to the public supply, have carried the major share of increased war loads. By the end of 1944 aggregate peak demands on public supply will probably exceed 42 million kw, an increase of about 13 million kw since 1939, or about 45%. To meet this load, public supply plants have installed 9 million kw since 1939, or 22% of the prewar capacity. It is interesting to note that, by voluntary coordinated effort of utilities, about 4 million kw of this capacity was actually in operation before Pearl Harbor and another 1½ million was already under contract at that date. More than half the kilowatts installed for war were planned and bought while we were at peace!

As would be expected, most of the new kw of demand built up during the war years has been derived from industrial operations. In 1939 only 49% of peak loads came from manufacturing, mining and related operations; these loads will account for more than 59% of 1944 aggregate peaks.

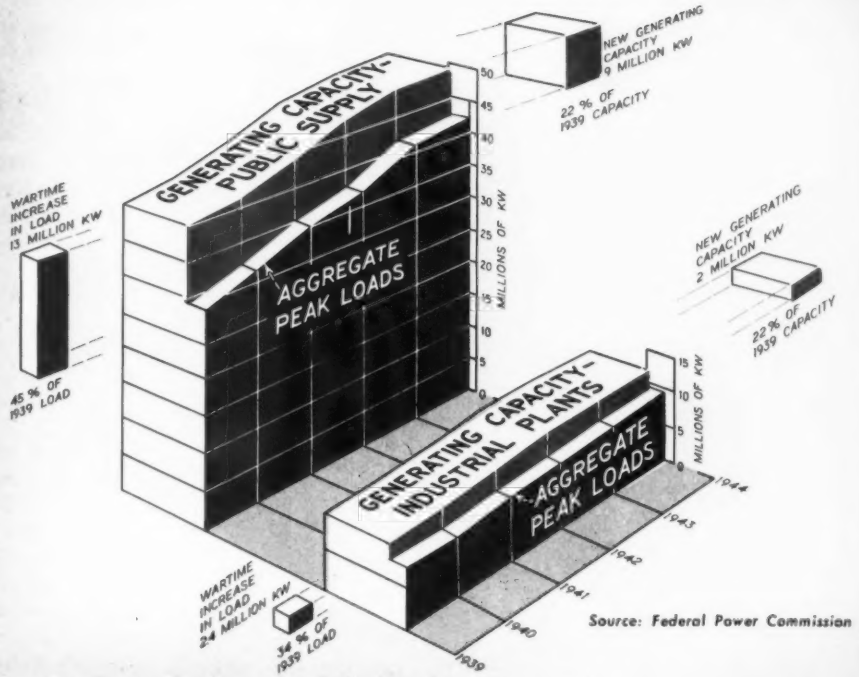
In 1944 also will occur the first real reduction in the approximately 10 million kw margin between aggregate peak loads and installed capacity. This margin of reserve is expected to fall below 8 million kw. While it has often been argued that total nameplate ratings and total added non-

The Battle of Production

While industrial kwhr use has more than doubled from 1939 to 1943, all other uses of electric power have risen only about 25%, considerably less than would probably have been the case had there been no war. War time, brownout and other conservation measures, together with lack of new appliances, have contributed appreciably to keeping non-industrial use at a minimum. Pent-up domestic and commercial demands can be counted on to help in absorbing kwhr in early postwar

Utility loads have increased about 50% more than new capacity installed since 1939. This year will see margins of reserve at a critically low ebb. On the other hand, installations have nearly kept pace with rising loads on industrial-plant generators. Much of the new capacity has been allocated to specific new war facilities and thus does not represent a true expansion of the existing industrial power supply

SPARE CAPACITY DANGEROUSLY LOW



Source: Federal Power Commission

coincident peaks are both meaningless because the whole capacity of the nation cannot be delivered to points required by growing loads, this margin has served as an excellent index of healthy ability to supply new as well as existing load. Stated another way, present installed capacity is inadequate to supply American industrial, commercial and residential loads with the safety to which consumers have become accustomed in peacetime. From this it can be reasoned that utilities, which still account for more than 80% of the total national supply, will be faced with need for much new capacity in early postwar years.

At the end of this year, total installed capacity of central power stations will approach 51 million kw with less than a million kw scheduled for installation in 1945. Tapering off of new installations was planned by WPB to conform to a decreased rate of new demands, a policy which seems well justified by present estimates of only 4% increase in peak loads and 6% increase in energy use for 1944 and the probability of a reduced armament program before 1945 peak loads have to be met.

ESTIMATES of peak demands and energy use have been predicated on continuation of war production at about present levels. For the remainder of this year at least, such estimating would seem a sound policy since (1) experience with "cutbacks" has thus far indicated that military demands for new items have called for more materials, men and power than the abandoned items, and (2) effect of even major military success in Europe cannot be translated into reduced power use for a matter of months.

Should there be some relaxation in the rate of arms production dictated by improvement in the military situation, the effect will most likely be felt late in the year at time of system peaks. Such a contingency can hardly be viewed as other than a welcome relief for overstrained power capacity which must meet the highest coincident loads in history with less margin of spare than ever before.

INDUSTRIAL generation, according to a recent survey published by the Federal Power Commission covering about 20,000 plants that use more than 90% of industrial power, has increased in less proportion than purchased power. The 1939 total of some 9 million kw of generating equipment in industrial plants has been augmented by new units totaling about 2 million kw while aggregate new demands add up to 2.4 million kw.

Out of an estimated total generation by central stations and industrial plants in 1944 of about 280 billion kwhr, manufacturing and mining establishments are expected to make for their own use in excess of 53 billion kwhr and purchase an additional 119 billion kwhr, a total of 172 billion kwhr, 61% of all electric power generated.

Purchased energy for industrial use in 1944 is estimated to be nearly three times that of 1939 while generation within industrial plants for their own use is expected to increase only 66% over the same period However, it is apparent that

industrial generating units are turning out more kwhr per kw since plant factor for self-generated power has increased, on the average, from 37% in 1939 in gradual steps to 49% in 1943. Corresponding load factor has increased from 52% in 1939 to an expected 64% in 1944 while load factor of purchased energy has risen from 40% to 58% in the same period. Maximum demand on industrial generators has increased from 72% in 1939 to 79% in 1943, latest figure available.

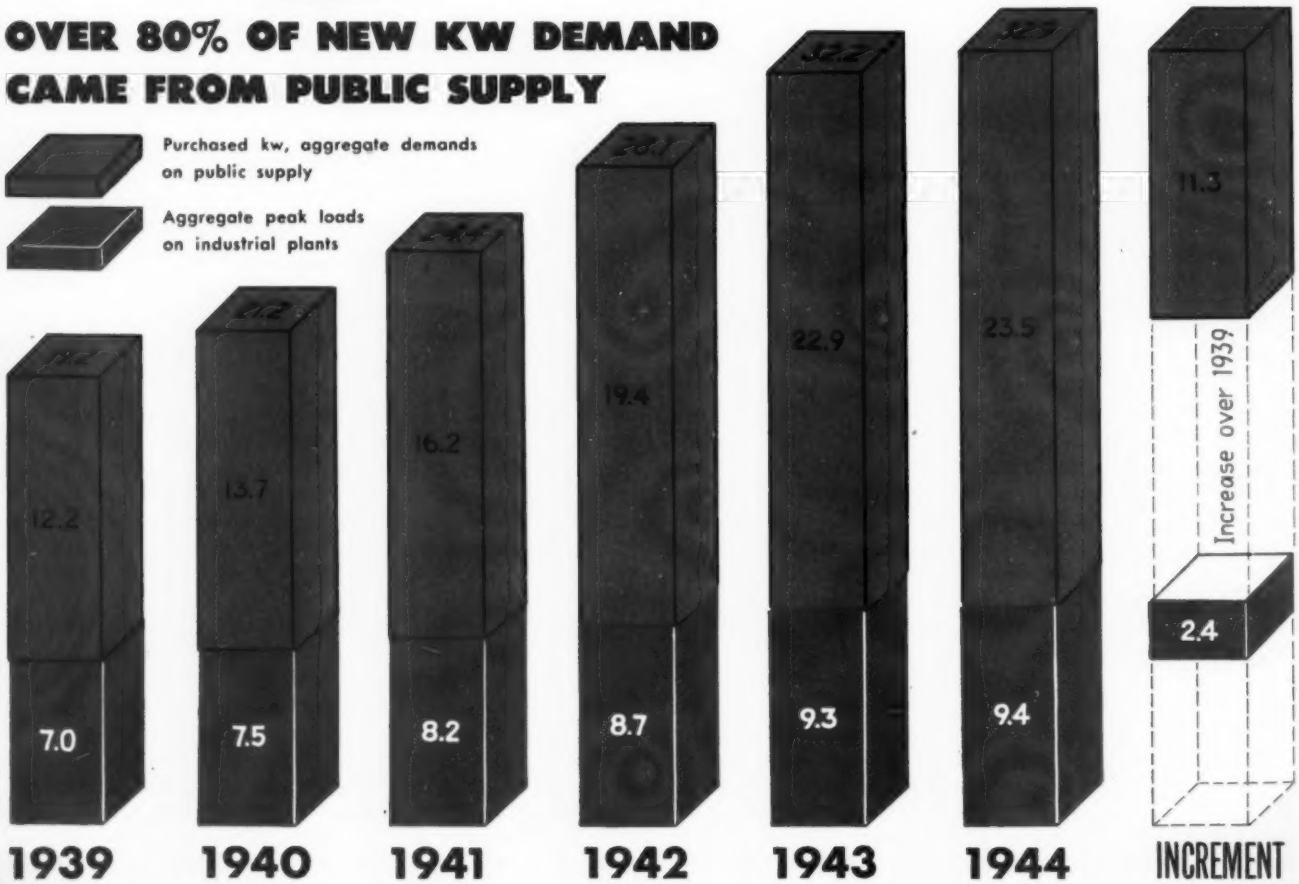
Problems of reconversion of war industry to civilian uses will affect power equipment to a far less extent than would be expected from a casual assumption that load increases accumulated during war years will vanish with cancellation of military contracts. A statement by the Committee for Economic Development that postwar industrial activity will start at a level about 45% above that of 1940 by no means indicates that power demands will return to a corresponding stage. Experience of doubling and tripling dollar value of industrial output during conversion of facilities to war production was not accompanied, as some predicted, by anything like a proportional increase in kw and kwhr demands.

NEARLY 90% OF 1944 PEAK GOES TO MANUFACTURING

Since the great bulk of industrial power demand comes from manufacturing, the postwar bread and butter of most utility and industrial power engineers depends on returning factories to civilian production as rapidly as possible when the "go" signal is given. First step is development and engineering of new products so that retooling will not take too much time

First impact of reduced manufacturing output during temporary period of reconversion will be welcome relief from heavy demands on utilities. Purchased power has nearly doubled in kw demand since 1939 while industry-generated power has increased only one-third. Reconversion will be made easier since bought kw can be transferred anywhere within reasonable distances while power units in industrial plants must be moved

OVER 80% OF NEW KW DEMAND CAME FROM PUBLIC SUPPLY



Source: Federal Power Commission

What Reconversion Means to Industry

Why talk of reconverting industry to civilian production when (1) the hardest fighting and greatest expenditure of munitions is still ahead in Europe and (2) Japan has been beaten only at the fringes of her empire? Army and Navy spokesmen fear that the psychology of starting back to peacetime goods will cause a rush of labor to more permanent jobs than munitions-making seems now to offer.

In this the military are forced to take a strong stand because actual combat must be timed and coordinated with shipment of supplies. Having set a rate for combat, production must follow schedule or armies will lack ammunition. Success in battle calls for more supplies, not less. A plane not lost continues to use gasoline and bombs.

On the other hand, War Production Board heads, experienced in converting industrial plants to war production, know that it takes a long time to get the first one of a new kind of product actually off the assembly line and on a shelf in a store. They know that months must be spent in retooling and testing experimental designs before the wheels roll and machine operators draw a full week's pay.

Donald Nelson, who bridled the nation's industry and whipped it into making war goods, wants to get started on engineering and design of peacetime products for which there is already a huge pent-up demand. Bernard Baruch, sage industry chief of World War I, is quoted on reconversion as saying "Hurry, hurry, hurry!"

CUTBACKS up to 30% of dollar war production will follow a German surrender. Opinions vary somewhat on how much and what kinds of goods will be first affected, but all agree that there will be at least two distinct stages of readjustment, one when the end of the European war is in sight and another separate dislocation of industry when the Pacific theater no longer needs weapons.

Military men must guard against what is to them the worst contingency — dragging on for months of a bitter slugging match calling for continuous supplies of expendable material. A sudden collapse, as in 1918, would be welcomed by the military and all of us, but would catch industrial management off guard. Unless experimental models have been built, engineering completed and retooling planned, factories now making the expendables of war can do nothing else but close down completely or continue at low levels of production.

Of course no one expects all military contracts to be cancelled simultaneously or even soon. But the possibility exists that events will take an unexpected turn and the responsibility for safe conduct of the nation's business will be handed without much warning from the Chiefs of Staff to industrial executives.

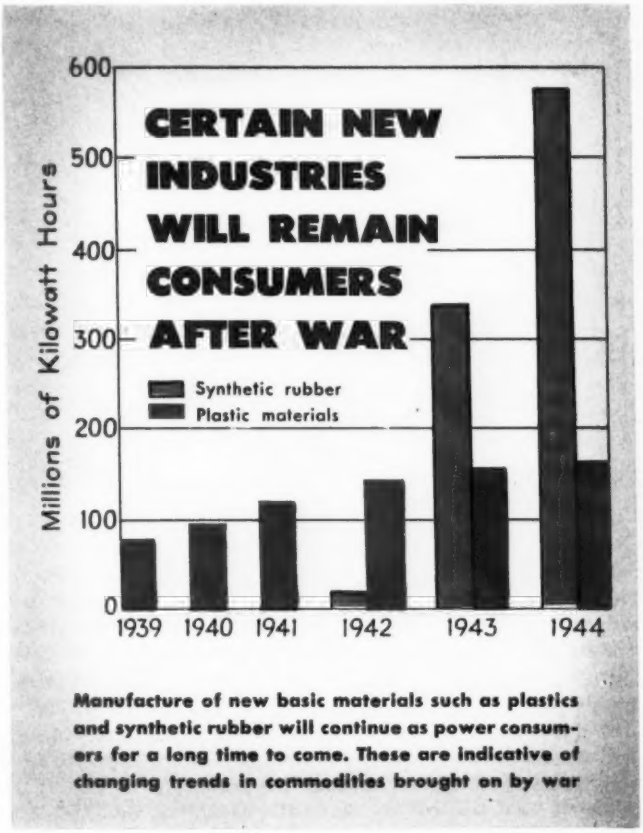
With this situation staring them in the face, and the prospect of payrolls to meet without corresponding income, and indefinite layoffs of workers, executives want to guard against too sudden stopping of the war production machine, now in high gear, by planting the seeds of some one or more items they can start making in a matter of days or weeks. This is a job for engineering staffs.

WPB orders (1) permit a manufacturer to make an experimental model of any postwar product (2) ease aluminum and magnesium into civilian use (3) allow industries to contract now for machine tools they will need for civilian production, and (4) let WPB regional directors void limitation and conservation orders for individual manufacturers who have men and machines available not suited for further war contracts.

Undoubtedly there will be continued modification of these instructions as the pattern of reconversion begins to appear. The significant import of these orders is that planning of reconversion is imminent.

CIVILIAN goods will not begin to appear for a long time to come. Actual requirements of war production will keep most plants loaded to the hilt supplying battle fronts. Invasion of Europe brought deep-seated shifts in the production program with emphasis on big guns, shells and tanks. In the Pacific theater, the campaign against the Japs is at least six months ahead of schedule so that tankers, landing craft and supplies scheduled for delivery late in the year are needed now.

All this simply means that the war is moving faster than expected. Just as a military mind must prepare for reverses that mean the war moves slowly, those charged with keeping the industrial wheels in motion should prepare against the contingency that unexpected collapse of the Germans would leave the home front lacking strategic



Manufacture of new basic materials such as plastics and synthetic rubber will continue as power consumers for a long time to come. These are indicative of changing trends in commodities brought on by war

plans that could be put into action at once. Mr. Nelson's four steps are aimed at encouraging manufacturers to prepare detailed plans soon for bridging the gap between ending of the German and Japanese conflicts and for making the changeover as rapid as possible when the "go" signal comes.

However, any plans for the future must be so drawn as to interfere in no way with the high level of present war production. Having built a vast arms-producing machine and the power plant to supply it, the nation would be foolish indeed if it did not insist on top speed until the

REQUIREMENTS OF MAJOR INDUSTRY GROUPS IN MILLIONS OF KWHR BY GEOGRAPHICAL AREAS

1943

(Estimated for 21,235 establishments)

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	United States
Manufacturing industries:										
Food	158	1,102	1,640	1,230	383	199	333	164	683	5,892
Tobacco	*	22	4	3	67	12	0	0	0	108
Textile	1,928	850	153	16	5,252	936	97	0	25	9,257
Apparel	5	33	22	12	7	18	3	0	2	102
Lumber	10	21	61	23	52	72	102	109	1,071	1,521
Furniture	55	90	187	23	102	51	19	*	74	601
Paper	2,020	2,111	2,554	384	2,047	498	973	5	1,333	11,925
Printing	11	117	151	25	9	7	2	0	22	344
Chemicals	250	5,612	5,864	1,368	5,539	3,269	3,338	1,688	2,001	28,929
Petroleum and coal	96	911	826	159	69	55	1,981	43	674	4,814
Rubber	221	275	1,102	17	37	147	1	31	147	1,978
Leather	80	121	117	25	22	9	0	2	2	378
Stone, clay, and glass	87	1,678	1,321	611	523	504	458	85	806	6,073
Iron and steel	769	8,348	11,093	397	1,580	1,097	160	162	668	24,274
Nonferrous metals	735	5,984	1,432	91	1,297	4,820	1,467	2,032	6,116	23,974
Electrical machinery	542	1,592	909	59	363	7	7	5	42	3,526
Machinery, except electrical	785	1,212	2,761	255	88	58	120	10	167	5,456
Automobiles	7	509	3,820	58	25	12	2	1	24	4,458
Transportation equipment	496	1,462	1,546	259	751	161	475	16	1,933	7,099
Miscellaneous	141	484	125	6	18	3	0	*	5	782
All manufacturing	8,396	32,534	35,688	5,021	18,231	11,935	9,538	4,353	15,795	141,491
Extracting industries:										
Metal mining	4	196	248	514	26	71	78	1,916	116	3,169
Coal Mining	0	2,127	630	49	1,118	465	19	125	19	4,552
Nonmetallic mining	12	133	198	27	226	49	77	29	59	810
Petroleum and natural gas	0	15	41	45	1	*	292	9	216	619
All extracting	16	2,471	1,117	635	1,371	585	466	2,079	410	9,150
All industries[a]	8,412	35,005	36,805	5,656	19,602	12,520	10,004	6,432	16,205	150,641

* Less than 500,000 kwh [a] Excludes government owned and operated establishments.

fighting men finally say "we have enough of everything". This means that control of materials and labor must be firm until it becomes obvious that an excess of both exists.

WPB has often declared that it will relax materials control as soon as military needs permit. Some progress in this direction could already be made except for the fact that manpower has become the criterion and control of this shortage, involving persuading or forcing human action, is much more complex than for materials.

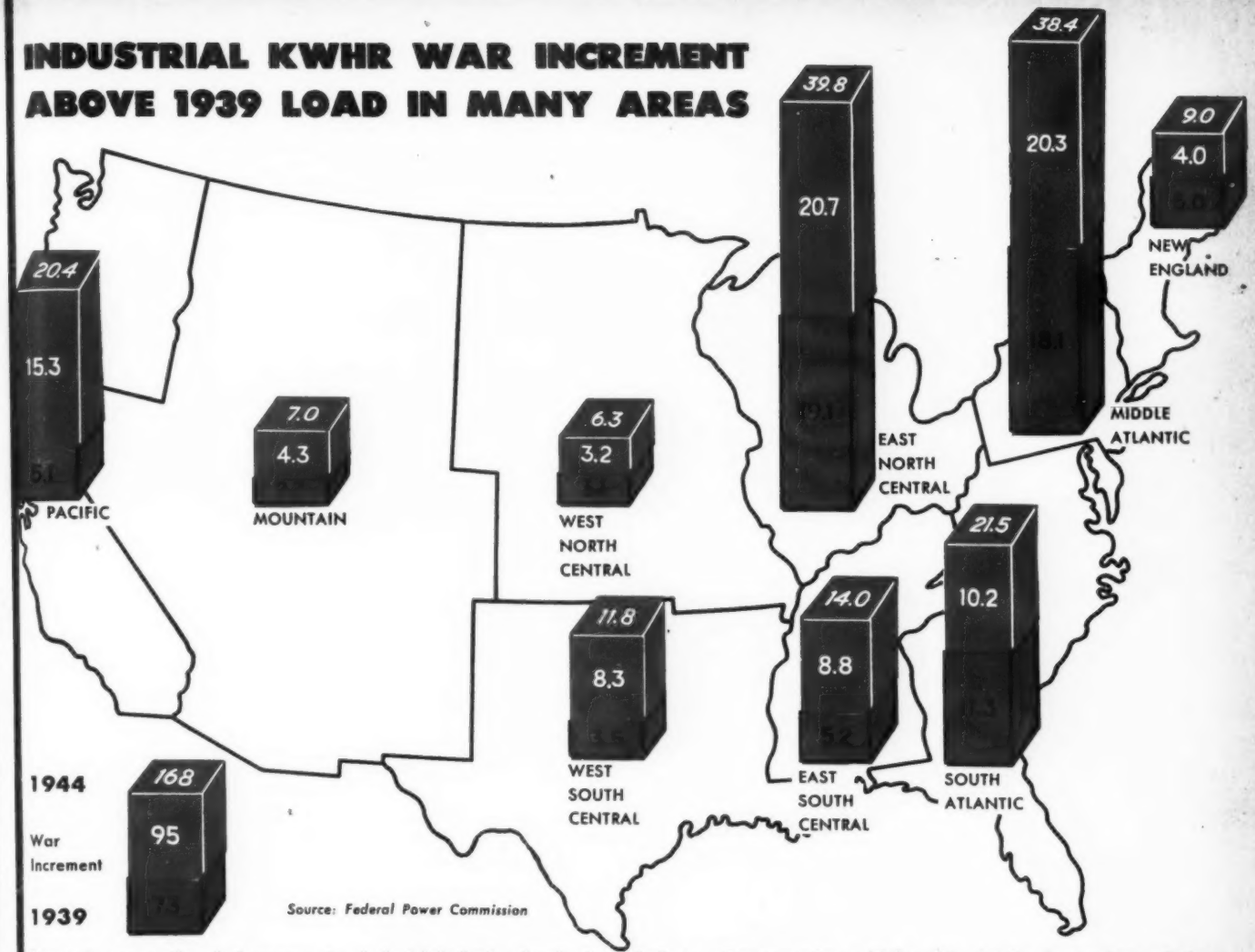
FORECAST of the pattern of reconversion as it affects power application and supply requires review of (1) the geographical location of power-using war plants the output of which can be used only for military goods, and (2) the fundamental changes in industrial methods brought about as a by-product of war developments.

Considering the geographical aspects first, note from the map on the opposite page that in California, Oregon and Washington, forming the Pacific coastal region, additional electric loads accumulated during the war years total about three times the load previously existing in the area. Much of this load is represented by war plants built solely for war purposes. These are not extensions or expansions of existing industry "converted" to war purposes, they are new plants designed for a single item needed for war.

Most of these plants cannot be readily converted back to any peacetime production. Therefore a day will soon come when they must, rapidly or gradually, close their doors and leave their employes without work. Where new war plants are a large part of total industry, dislocation will have severe economic and political consequences.

In New England, on the other hand, new load does not quite match previously existing load. The majority of the war production schedule is being carried on in existing plants or extensions to them by manufacturers who were in business many years before the war. For these areas, reconversion will be easier and faster than where new facilities predominate.

METHODS and materials have been greatly improved under stress of war. Aluminum, magnesium, steel, plastics and even wood have been made into parts and structures undreamed of a decade ago. Welding — by arc, gas, spot and seam — has speeded joining of parts into assemblies. High-frequency



Largest proportional increase in industrial kwhr loads is three-to-one ratio of Pacific Coastal region, mostly accounted for by brand-new war-born industry. Opposite situation obtains along Atlantic coast where one-to-one proportion of new loads is largely extension and expansion of older peacetime industry. Reconversion will be (1) simpler in sections of the country where older industries were well established but (2) new industries that happen to be large power users will find more favorable conditions where excess electricity supply seeks a market. Plans must take account of power facilities

electronic power spreads tin evenly and more thinly on steel for food containers. Similar units accomplish the near-impossible by welding wood and plastics.

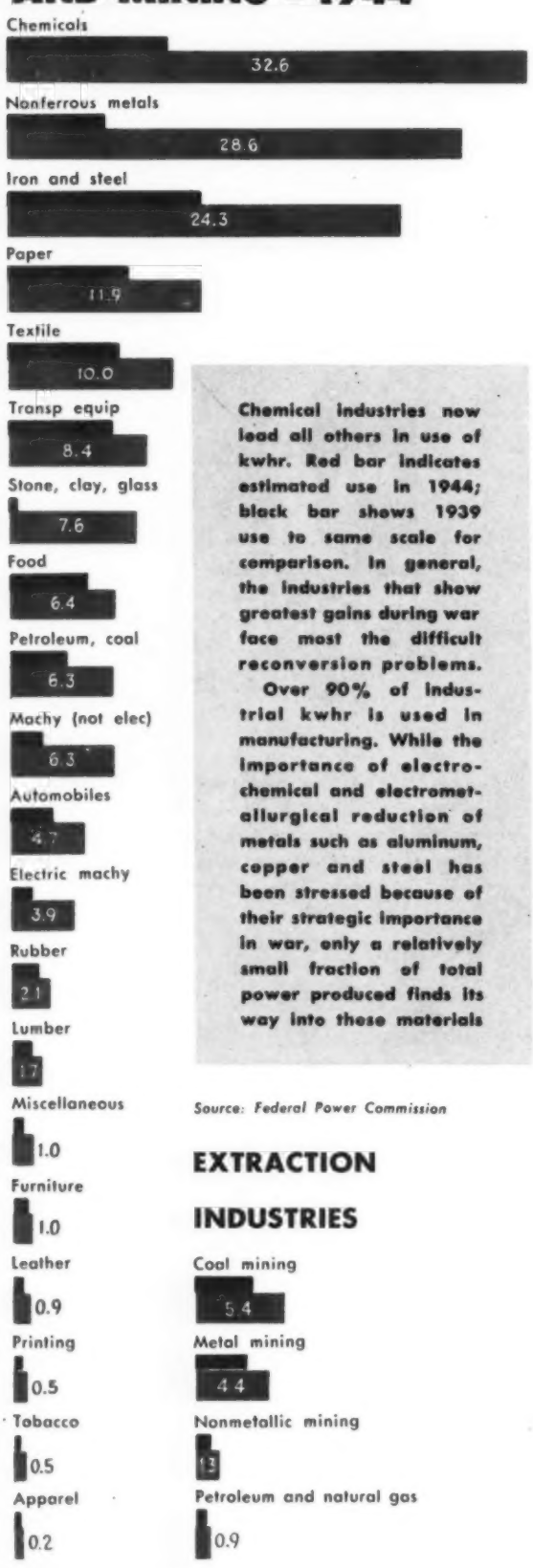
All this spells new problems for design engineers and production experts, problems that inevitably will delay the appearance of heavy equipment as well as consumer goods in the open market. The nation and its factories are now less prepared for peace than once it was prepared for war. Conversion to war production took more than two years before design and construction men had the job in a satisfactory state to suit the military high command; it will take at least as long to reconvert to a condition satisfactory to the American people.

What steps should now be taken in the "twilight" zone when the rate of war production still must be kept at peak but when unmistakable signs of dawning, visible combat progress, begin to be evident? First, provisions for legal termination of war contracts have already been reasonably well worked out in advance. Second, Mr. Nelson's four orders indicate that WPB is disposed to use present absolute control of materials in such a way as to facilitate planning a changeover as soon as practical. Third, manpower, not materials, stands in the way of actual motion and manpower excess, when it begins to occur, becomes apparent much more quickly and vocally than any shortage of physical supplies, hence gives the signal city-by-city and industry-by-industry when the time is ripe. Fourth, the power industry has within its grasp means of helping bridge the gap quickly and where needed most.

POWER PLANT design and construction engineers now have completed or nearly completed all high-priority construction. While operating forces still struggle to get daily quotas of steam and power to war-production lines, executives can even now call in designers to prepare plans for badly needed (1) new plant (2) plant extension and modernization (3) major maintenance operations postponed for the duration.

Since normal sources of power plant equipment have not converted to different products — turbine and boiler manufacturers, pump and fan makers and many others — reconversion for them means only minor changes in specifications. Rebuilding worn and weary parts of the power supply system can begin quickly and efficiently if the plans are ready when X-day comes.

Prepare for Peace



Chemical industries now lead all others in use of kwhr. Red bar indicates estimated use in 1944; black bar shows 1939 use to same scale for comparison. In general, the industries that show greatest gains during war face most the difficult reconversion problems.

Over 90% of industrial kwhr is used in manufacturing. While the importance of electrochemical and electrometallurgical reduction of metals such as aluminum, copper and steel has been stressed because of their strategic importance in war, only a relatively small fraction of total power produced finds its way into these materials

Source: Federal Power Commission

Next several months are expected to see continual change. The see-saw of fighting cannot help but be reflected in home-front vacillations. Indications are, however, that (1) WPB will gradually adopt a more lenient attitude toward release of new central-station power equipment (2) some machines will be authorized for export (3) certain items such as aluminum conductor will be available for practically any real need (4) manufacturers of some power equipment items may have to curtail production for lack of high-priority orders.

Some large land turbines and their associated equipment will soon be authorized because (1) war time is distinctly unpopular in some sections of the country and eventual return to standard time, probably early in 1945, will add about 1½ million kw to peak loads (2) margins of reserve are admittedly too thin (3) utilities manpower problems interfere with a full maintenance schedule so that equipment outage is increasing, and (4) age, obsolescence and overwork are beginning to take toll of all equipment.

Furthermore, the end of some phases of the war program is in sight. Bulk of the Navy turbine schedule will be completed this year; by the end of 1944 the Navy will have more horsepower afloat, about equally divided between steam and diesel, than all land power-generating equipment in the country. By mid-1945 manufacturing facilities devoted to construction of warship power units may be begging for work to keep valued employes on the job. To get turbines in the shop next Spring orders should be placed this Fall.

PENT-UP demand for immediate new generating units probably totals more than a million kw with another million ready to follow if any encouragement is offered. Add to this the need for special power machinery for Russia and occupied territory where demolition has left wide areas entirely destitute of power supply and it becomes obvious that demands for equipment will greatly exceed any possible releases for many months to come.

The problem is further complicated by a situation much discussed during the beginnings of giant-scale war production, that of "components". In order to release one turbine for construction, materials and manufacturing facilities must be committeed for the whole plant – pumps, piping, valves, meters and other parts. Any one of these items that cuts across a pressing military need holds up the entire installation schedule.

This situation, of course, cannot help but about-face the instant German surrender can be visualized. Whether collapse of the European front takes place soon or is long delayed, the presence of accumulated stores of munitions here and abroad will bring almost immediate curtailment of 30% or more in dollar value of war goods.

Preparedness for this contingency becomes the number one job for power engineers right now, not only as a contribution to the nation's' stability in chaotic shifts to come, but as plain selfish good business. Because most makers of power machinery have continued to make pretty much the same items during war as they previously made for peace, their reconversion problems are simple. When the time comes, delivery of many items can be effected quickly.

The immediate need is for plans and specifications drawn up and ready so that orders can be placed and construction started with a minimum of delay. Consulting engineers, with most of their war projects completed and

By Planned Maintenance, Modernization

in operation, report a lack of new work at a time when the planning of new equipment and modernization of industrial plants should be well started.

Because engineering planning takes both time and skill, the fact that new power equipment may become available suddenly, even though probably not soon, should be made clear to industrial executives so that power supply can be coordinated with general postwar plans.

Preliminary maintenance and modernization steps should dovetail into a long-range power program that will result in economical generation and use of all power facilities in postwar. Suggested procedure involves making a rough outline of the kind of plant that would be built under usual business conditions to require only normal maintenance for a relatively long term of years. Expected higher fuel costs put more emphasis on fuel-saving than in prewar practice and equipment should be able to handle a wide range of coals, or more than one fuel if oil or gas.

OUTLINE should include electrical-system improvements, extension or renewal of piping, air conditioning, and any other improvements related to power equipment. Such preliminary plans and over-all cost estimates, even very rough figures, help give a picture of what must be included in future planning of all facilities or what parts must be delayed or abandoned as too costly. Thinking ahead in this way avoids wasting maintenance money on equipment soon to be retired.

Because release of materials and availability of men depends on war progress, step-by-step accomplishment of the power program should be timed by a priorities system to get first things done first. Making detailed plans and accurate cost estimates for the first few steps, and obtaining approval, will permit starting work promptly.

While the procedure sketched here should be second nature to experienced power operators, this may serve as a reminder that now is the time to start. An organized plan will also serve as a basis for requests to WPB for the priorities that will undoubtedly be necessary during practically all stages of reconversion to assure an orderly process of satisfying more pressing needs first. WPB is not now soliciting new priority requests, in keeping with a "win the war first" policy, but the time will soon come when materials and equipment will be allocated on the basis of need for return to civilian industry rather than on the present system of degree of war importance.

PLANNING DEPENDS ON THIS ORDER OF EVENTS

NOW: Release of small amounts of alloy steel, tin, zinc, copper, and larger quantities of aluminum for experimental models, research and development

EARLY FALL: Allocation of generating units and other power equipment to Russia and occupied territories. Release of a few large turbines and associated equipment to central stations for construction in 1945 when turbine shops near end of Navy jobs

LATE FALL: Easing of restrictions on carbon steel and perhaps forgings as heavy-equipment program tapers off

NEXT WINTER: Depending entirely on progress of the European slugging match, either gradual easing of materials and manpower locally, or rapid steps under WPB control to speed reconversion

NEXT SPRING: Pacific war will need only a fraction of present production facilities. Power plants will enjoy a much-needed breathing spell for long-deferred maintenance and perhaps some construction

FIVE STEPS FOR POWER ENGINEERS TO TAKE NOW

FIRST: For industrial plants, begin by making a complete plan of power facilities that will be needed, assuming that postwar business will be good and that obtaining money will be no problem

SECOND: Break this long-term plan into bits and pieces — boiler equipment, generating units, electrical system, piping, lighting, heating and air conditioning

THIRD: Get sound opinions from consulting engineers, other plant operators or manufacturers' representatives as to tentative over-all plans and layout

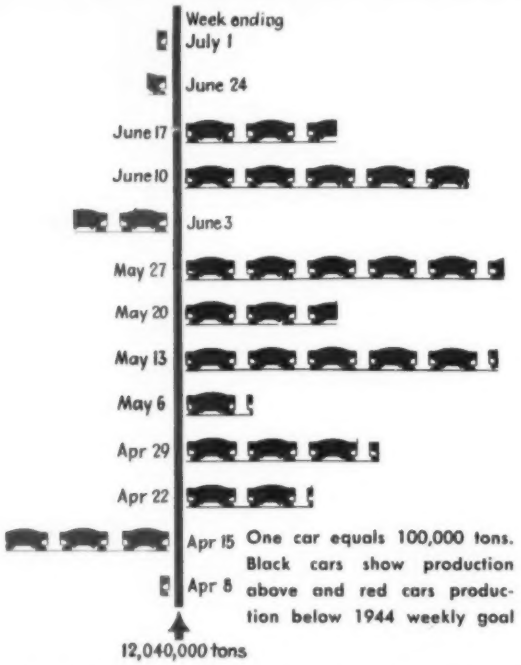
FOURTH: Assign each step of the plan a priority, as follows: (1) essential maintenance to keep plant running, (2) extensive maintenance that has had to be postponed, (3) modernization for efficiency or increased capacity, (4) new equipment to replace obsolete or worn out machinery

FIFTH: Have plans, specifications and even tentative contracts ready to carry out each step as soon as regulations permit

FUEL Remains A

Transportation better but supplies of all fuels will remain tight for the duration. Postwar thinking must consider eventual trend to poorer coals and to less favorable price and supply conditions for fuel oils

COAL OUTPUT BEATS FIRST-QUARTER GOAL



SFAW has set 626 million tons as the goal for the "coal year" beginning April 1, 1944. This means producing at the rate of 12,040,000 tons per week for 52 weeks. First-quarter operation, charted above, ran better than "par" but manpower losses and other difficulties cast doubt on the ability of the mines to maintain this rate

HOW OIL MOVES EAST:

NOVEMBER, 1943

PAW chart

Tankers carried virtually all oil to East Coast in prewar days; this was cheapest transportation method

Fuel problems facing power engineers this winter and the ensuing year differ from those of the immediate past only in degree. Coal moves up in the scale of urgency as against oil, which enters its third year of strict rationing. For all fuels, production holds the stage as the major difficulty, taking precedence over transportation. While there is no room for complacency, intensive use of existing facilities and completion of alternative routes make it seem likely that we will be able to move all fuel produced.

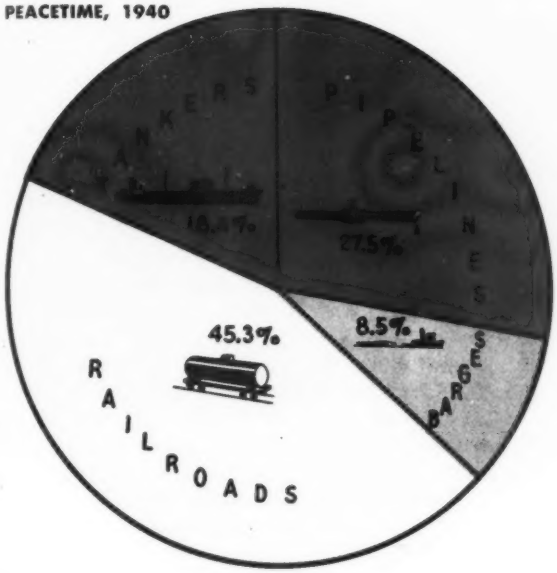
Posing no immediate problems for which the power engineer does not already have a guide in war-born experience, the fuel situation nevertheless will play an important part in many of the decisions to be made as industry begins to reconvert and enter on postwar production. Viewed by some as critical, the question of future oil supplies looms large in the public eye, but equally significant changes appear to be in the making with respect to the other major fuels. The following pages present first a summary of the current situation to guide immediate action and then a digest of available facts on future fuel trends to assist long-range planning.

COAL production in 1943 fell short of actual consumption by about 25 million tons, largely as a result of work stoppages. Stockpiling proved its worth by absorbing this deficit and limiting the effects to local short-term supply dislocations. We paid the bill in depleted stocks: They fell from 86 million tons on Jan. 1, 1943, to about 57 million at year end, only a little more than a month's backlog and much too close for comfort.

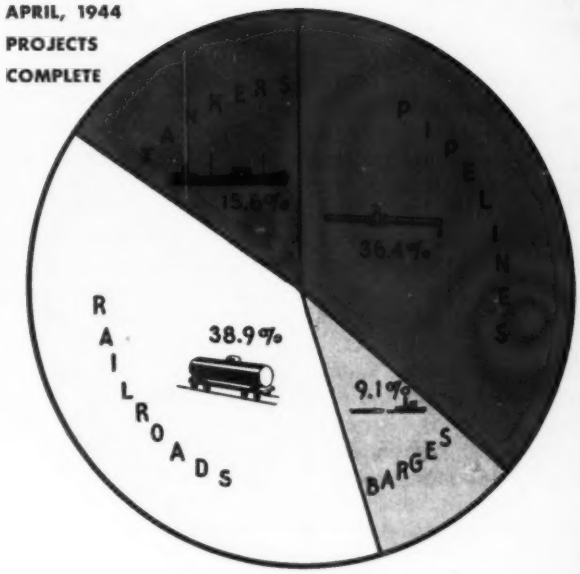
We entered 1944 with stocks at a low level and with ever growing needs. For the "coal year" beginning April 1, the Solid Fuels Administration for War set a production goal of 626,000,000 tons, an average of about 12,040,000 tons per week for 52 weeks. This includes estimated increases in industrial requirements and shipments to Europe for military operations. Foreign deliveries will be necessary even though England is scheduled to supply more coal to Europe and American machinery will be sent to boost British output.

Problem for Engineers

RAILROADS, PIPELINES AND BARGES REPLACE TANKERS



Boosted rail shipments quickly filled breach left by diversion of tankers, while pipelines were being built



Rails still handle large volumes but completion of pipeline program and new barge routes ease the strain

For the first quarter of the coal year production set a record, averaging 12,250,000 tons per week. Loss of miners, holidays and the usual seasonal slump cause SFAW to doubt that this production rate can be maintained.

Manpower proves the biggest headache. Coal-mine employment has fallen to the lowest level capable of sustaining needed production. Bituminous employment dropped 25,000 during 1943, leaving only 415,000 at work on Jan. 1, 1944. Further losses cut this working force to 402,000 by June of this year. Average miner's age rose from 32 to 45, threatening serious losses from superannuation. Only 5,585 of the 17,486 physically fit soft-coal miners under 26 are deferred as essential to coal production.

Recruitment drives are under way in areas to which miners have migrated, and in others where mines do not operate full time. Referrals will be made to most efficient mines, and area-stabilization programs will be strengthened.

Machinery breakdown runs second only to manpower as a headache. SFAW has secured from WPB higher preference ratings for manufacture of equipment and parts. All capacity of the mining-machinery industry not taken up by the Army and Navy will go to coal mines, except for the small amount to go to England.

PRODUCTION during the rest of the 1944 coal year will suffer as a result of these factors, SFAW believes. They expect a deficit, particularly in the Southern Appalachian coals. Whether or not this is the case, the situation will remain tight, with little chance to escape from the hand-to-mouth conditions forced on us by depleted stockpiles.

Thus we may expect to see diversion of shipments continue as a means of meeting local shortages. Begun under the crisis conditions following 1943 work stoppages, such diversions from plants with ample stockpiles to war plants facing shortages stretched current production to cover essential needs by making maximum use of stockpiles.

Limitations on shipments to all plants with stockpiles, in effect since last winter, may be expected to continue. This action (Regulation 10) provides for plants so affected to restore their stocks to safe levels if they fall below specified amounts which vary from industry to industry. This rule is being relaxed in areas where bituminous production has increased and every opportunity to build stores should be grasped.

CONSERVATION as a keynote for 1944 action needs no more justification than the situation outlined here. Always good business, efficient burning of coal and elimination of waste in using its products will provide a much-needed margin of safety, helping to replenish stockpiles and relieving the cruel pressure on mines and railroads. Setting as its goal a saving of 25 million tons, the National Fuel Emergency Council, formed by SFAW, began early this year a nationwide conservation program.

To stimulate coal saving in small and medium-size industrial plants and commercial establishments, NFEC has enlisted several thousand volunteer regional engineers. These

will advise with, and coordinate the efforts of, "waste chasers" in each plant, who will seek ways to boost firing efficiency, stop heat losses and eliminate waste in use of steam, electricity and other products of the combustion of coal. To assist fuel saving in the space-heating field, WPB has made available materials for heating-system controls for some 950,000 residential, commercial, institutional and industrial plants. Repair and maintenance materials will be available without priority.

With regard to coal, the 1944-45 job for power engineers shapes up like this: (1) Place orders as far ahead as possible and stockpile as much as permitted under present regulations, (2) allow fullest latitude as to size and kind of coal, (3) expect continued government regulation of coal distribution, keep informed as to the various orders and cooperate in them, (4) make sure that your own house is in order, and (5) cooperate in whatever way possible in the NFEC conservation program.

OIL production in 1943 averaged a record-breaking 4.1 million bbl per day, attained largely by drawing on flush fields. Texas, California, Louisiana, Oklahoma, Kansas and Illinois, in that order, accounted for 87% of domestic crude. Completion of wartime transportation facilities made an outlet for increased production in Texas, which contributed 40% of the total. California's boosted production went almost entirely to supply Pacific military demand. Although Oklahoma and Illinois were among the six largest 1943 producers, output in both fell below 1942, creating a shortage of crude in midwest refineries.

Last year saw completion of most new pipeline construction, putting transportation to the East Coast on a full wartime basis (see chart on preceding page). It is expected that deliveries of petroleum and products to the East by all means other than ocean tanker will hold at about 1.8 million bbl per day into the Fall, dropping considerably next winter. Authorities believe that transportation is available for all oil likely to be allocated to the East although rail deliveries depend on retaining the present 64,000 tank cars, holding hauls to present lengths or less, and operating in symbol trains under ODT control.

DEMAND for petroleum products in 1944 will rise to 5.1 million bbl per day in the last quarter, with 5.2 million predicted for first quarter 1945. This represents an expected average 1944 demand of close to 5 million bbl per day. Crude-oil production for 1944 is estimated at 4.5 million: the difference will be made up by imports of about 129,000 bbl per day and stock withdrawals.

Such withdrawals will reduce stocks to about 451 million bbl by March 1945. However, completion of several foreign refinery projects early in 1945 may reduce overseas military demand and permit building stocks to safer levels.

Peak production forces withdrawals from fields at rates somewhat higher than normally desirable, causing pressure loss and resort to artificial lift in some cases. If desired outputs are to be maintained, more exploratory drilling and development wells in proven fields are needed. Lack of manpower and materials holds back this work, reported to be more than 20% behind PAW's requested program of 24,000 wells. The oil industry continues to ask for higher priority ratings and to work on recruitment.

Refinery capacity, in general, proves adequate but changes in the relative demand for refined products pose many problems. The chart (right) shows how output of wartime products such as aviation gasoline, toluene and butadiene has grown nearly tenfold since Pearl Harbor. Conversion of existing plants and construction of new ones have kept production abreast of needs, but only by exertion of every effort.

The chart also shows how fuel-oil production grew to meet the enormous demands of the Navy, Army and war industry. Refiners operated to increase fuel-oil yield at the expense of automotive gasoline and supplied needed medium oils by blending light products with heavy, cutting into supply of industrial fuel oil to some extent.

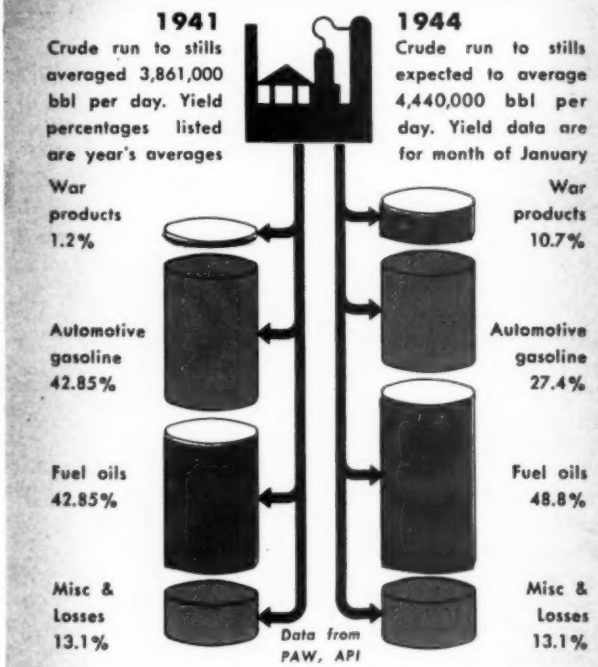
For the winter of 1944-45 there is likely to be little change in a fuel-oil situation with which power engineers have become familiar in two winters of shortage. The conversion program, its purpose served, is at an end. In some few cases, plants able to burn either oil or coal may swing back to oil, depending on the relative availability of the two fuels. Distribution and rationing may be expected to operate more smoothly this winter, with two years of experience as a guide. There is little or no prospect of any appreciable increase in supplies and none of early release from rationing.

GAS, like all other fuels, was produced in record quantities in 1943, 3.25 trillion cu ft being sold. Increased use in industrial plants and for electric power generation accounted for most of the rise but use as a raw material in new chemical processes proved a factor.

Principal problem has been the dwindling supplies in Ohio and Pennsylvania industrial areas, these being, respectively, the third and fifth largest gas-consuming states. The Appalachian fields, normal source for this gas, proved inadequate for war-expanded demands and restrictions followed. To ease this situation, authorization was granted in 1943 for a line from Texas to West Virginia and a tie from existing lines to Cleveland, making Texas gas available in Ohio.

However, it is likely that areas now short of gas will continue under restrictions until these lines are completed.

REFINERY YIELDS SHOW EFFECT OF WAR DEMAND


1941
Crude run to stills averaged 3,861,000 bbl per day. Yield percentages listed are year's averages
War products 1.2%
Automotive gasoline 42.85%
Fuel oils 42.85%
Misc & Losses 13.1%
1944
Crude run to stills expected to average 4,440,000 bbl per day. Yield data are for month of January
War products 10.7%
Automotive gasoline 27.4%
Fuel oils 48.8%
Misc & Losses 13.1%
Data from PAW, API

Larger shares of increased refinery output have gone to war products (aviation gasoline, toluene and butadiene) and to fuel oils. Even with fuel-oil output up, civilian supply must be rationed

Power Plans Must Heed Fuel Trends

Probable trends of supply and price for the major fuels of necessity bulk large in plans for postwar generation. Highly abnormal wartime conditions confuse the picture and make analysis admittedly difficult. Fortunately, a successful plan of action needs no exact forecast but merely a clear understanding of the factors shaping supply and price and enough flexibility to allow for minor deviations from expected developments.

Constructive thinking on fuel trends starts with a realization of the difference between power-plant fuel requirements and other uses. Many, if not most, of the latter are specialized and fuel choice depends on technical factors and economic considerations other than simple comparison of fuel cost and heating value.

For example, the automobile, largest user of petroleum products, is so firmly wedded to gasoline that threat of a shortage stimulates research in manufacture of synthetic gasoline with little or no thought to such an alternative as, say, a coal-burning automobile. There is simply no other fuel for the automobile as we know it today. Nor do we know any satisfactory substitute for the so-called metallurgical coals in steel making.

Closely allied to these highly specialized fuel demands, where technical considerations play a vital part, are others, somewhat less specialized, where over-all economic considerations establish a strong preference for one fuel over another. Thus most modern ships burn oil because savings in boiler-room and bunker space permit larger pay loads or longer trips without refueling, and labor saving is important. On the rails, proponents of diesel locomotives claim that higher availability makes one diesel equivalent to two steam units, an economic gain that offsets higher first cost and unit fuel cost.

In contrast, fuel choice for the power plant hinges largely on a direct comparison of fuel cost per unit of heating value and investment in equipment to burn it. For example, any fuel can be used for steam purposes, as firing of oat hulls and other unusual fuels shows.

Thus most other fuel buyers can outbid the power user when supply is limited. If oil refiners could meet gasoline demand only by reducing fuel-oil output, they would undoubtedly be forced to do so because motorists have always shown a disposition to pay the price. Likewise, steel mills will outbid power plants if metallurgical coal, which is also good steam coal, becomes short.

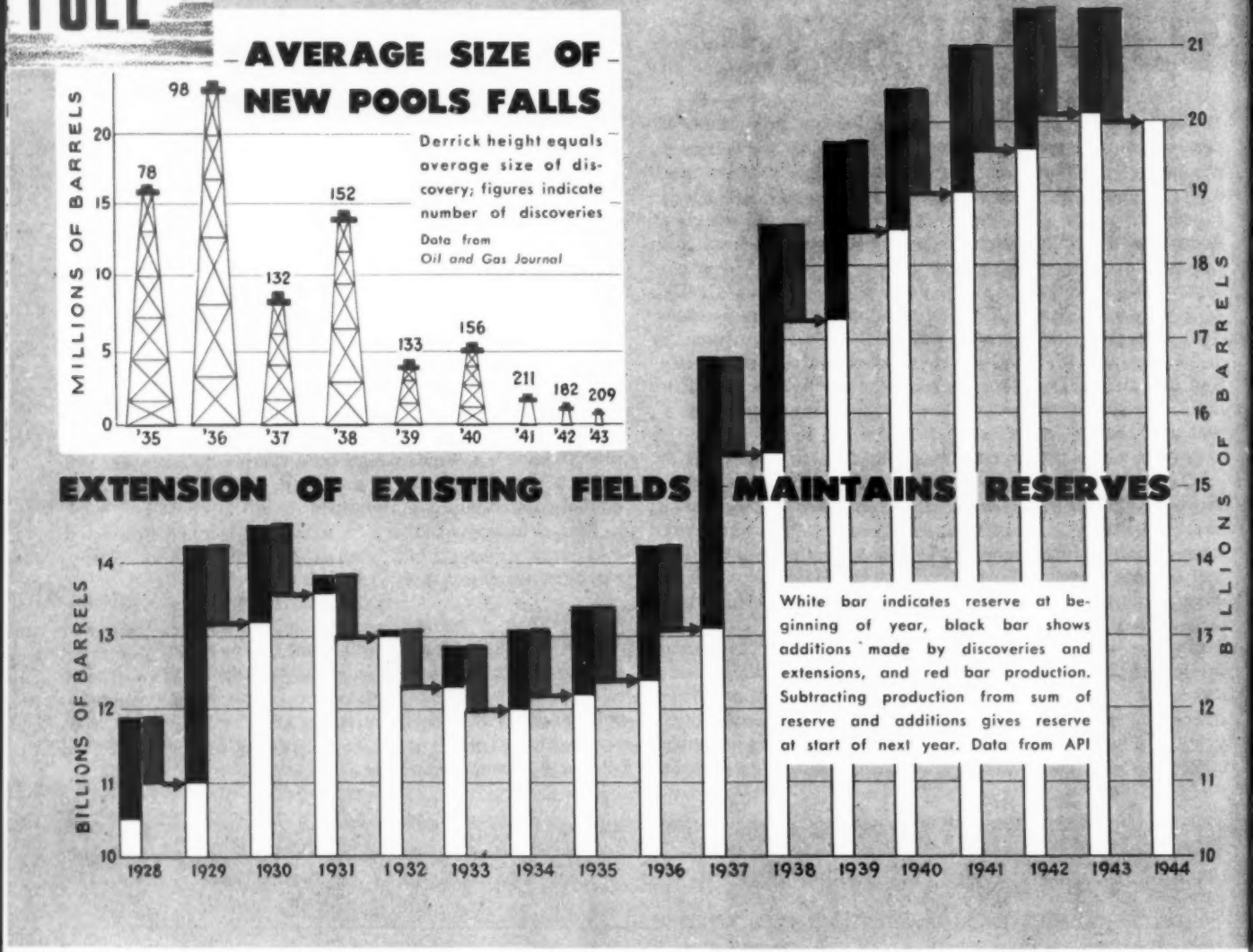
This situation need not be a hardship or a handicap to the power engineer, but it must be borne in mind always when evaluating supply and price trends for fuels.

COAL, because of vast known reserves (see table below), will continue as the dominant energy source. Although over-all stocks are enormous, seams of high-grade coking coals, suitable for metallurgical operations, are much more limited. Naturally, these coals are highly satisfactory for steam raising and are preferred by many power engineers. Competition in the mining in-

ESTIMATED MINERAL-FUEL RESERVES OF U. S.

Data presented before Senate War Minerals Subcommittee by A C Fieldner	C O A L							
	Anthracite Billions of tons	Low-volatile bituminous Billions of tons	High-volatile bituminous Billions of tons	Sub-bituminous Billions of tons	Lignite Billions of tons	Petroleum Billions of bbl	Oil in shale Billions of bbl	Natural gas Trillions of cu ft
Original reserve	22	56	1379	819	940	45	92	135
Reserve, Jan. 1, 1942	15	53	1353	818	939	20	92	85
Exhaustion, %	32	5	1.9	0.1	0.1	56	0	38
Production, 1941	0.056	0.101	0.398	0.012	0.003	1.404	0	2.770
Equivalent tons of bituminous*:								
Reserve, Jan. 1, 1942	15	57	1405	598	484	4.5	21	3.2
Production, 1941	0.055	0.109	0.413	0.009	0.002	0.324	0	0.107
Recovery, %	65	70	70	70	70	100	100	100
Life at 1941 rate of production**	177	366	2381	....	....	14	65	30

*13,000 Btu per lb. Heating values used in conversion to equivalent coal: Anthracite, 12,700 Btu per lb; low-volatile bituminous, 14,000 Btu; high-volatile bituminous, 13,500 Btu; subbituminous, 9,500 Btu; lignite, 6,700 Btu; crude petroleum, 6,000,000 Btu per bbl; natural gas, 1000 Btu per cu ft. **Years' life computed by multiplying reserves by percent of recovery and dividing the result by 1941 production. Although without direct significance, years' life serves as a useful index



dustry has led to what must now be viewed as overproduction of the "premium" coals and to serious reductions in reserves. Right now, metallurgical coals are critical and steel makers blame lack of suitable coal for production lag.

Postwar steel demand may be expected to taper off from present record levels but experts believe that remaining supplies of metallurgical coals should be guarded jealously It is within the realm of possibility that government action will be taken to conserve stocks but it is far more likely that normal working of supply and demand will act to put price of metallurgical coals out of reach of users able to turn to other, less critical, coals.

Farsighted power engineers will build their plans around the wide range of coals available in large quantities rather than on premium coals likely to become unavailable. In most cases, this means starting plant design with a fuel survey, always a logical procedure, and investing slightly greater sums in the more generously proportioned furnaces and firing equipment needed for the cheap and plentiful high-volatile low-fusion coals. Experience indicates that lower fuel cost amply offsets such additional investment.

PRICE of coal, after immediate postwar readjustments, may be expected to follow the general price trend. Savings from mechanizing mines to boost output per miner will offset probable higher labor cost.

If sharp cutbacks in industrial operations and transportation follow the conclusion of fighting, expanded mine output, part of it from marginal operations, may produce a temporary oversupply and lower prices as operators struggle to stay in business. This, in turn, may lead to return to a government-enforced minimum-price structure.

GAS reserves are increasing, particularly in the Gulf Coast area. Many of the new discoveries are condensate fields, which lend themselves to the growing practice of recycling, in which gas is returned to the field after processing for natural gasoline and similar higher hydrocarbons. Returned gas can be withdrawn later for fuel. The deeper drilling that is expected to characterize postwar crude-oil operations will increase gas yields, the ratio of gas to oil varying with depth.

Use of gas as a raw material for natural gasoline, isobutane and chemical products continues to grow and may eventually compete with fuel use on a substantial scale. Likewise, specialized industrial fuel use represents a higher kind of demand than power use.

Gas supply, by its very nature, is a regional matter and must be considered on that basis. Thus, in the Gulf Coast and Texas Panhandle areas, and around the Hugoton field of Kansas and the Kettleman Hills fields of California, where reserves are ample, future supply of low-cost gas seems assured. On the other hand, continued availability of gas in the Appalachian area depends on reinforcing dwindling reserves of those fields by gas piped in from more plentiful sources. While needed supply can be main-

HOW MUCH NEW OIL WILL EXPLORATION DISCOVER?

BILLIONS OF BARRELS
Known producing areas
Areas where oil may be found
Areas where oil discoveries are unlikely or impossible
Map adapted from The Lamp

Although extensions of known oil fields, and upward revision of recovery estimates, increase our reserves, experts point to the decline in discoveries as a danger sign. New oil in vast quantities must be found to meet future demands. As the map shows, much sedimentary rock, potentially oil-bearing, underlies the U. S., but finding new pools becomes more difficult and expensive. To learn how much more oil we have, we must explore on a greater scale and invent new geological tools

tained by such methods, it would seem reasonable for price to reflect added cost of transportation.

Pipeline extension to make gas available in hitherto unserved areas involves a number of questions. New construction must be authorized by the Federal Power Commission and thus will depend to some extent on government policy. Regardless of political considerations, it is natural for government to be conservation-minded and thus reluctant to authorize new lines. Furthermore, the coal industry has for years resisted competitive extension of natural-gas supply to new areas.

OIL supply is today's biggest question, with expert opinion honestly divided and lay thinking confused. However, some confusion disappears if the short-term war problem is divorced from the long-term one.

The immediate question deals only with oil known to exist, not with discoveries. Stated simply it is "can we bring oil to the surface fast enough to meet record war demands?" For the war years we have more than enough known reserves; getting them to the surface is a problem because oil flow from a well cannot be regulated like water from a tap.

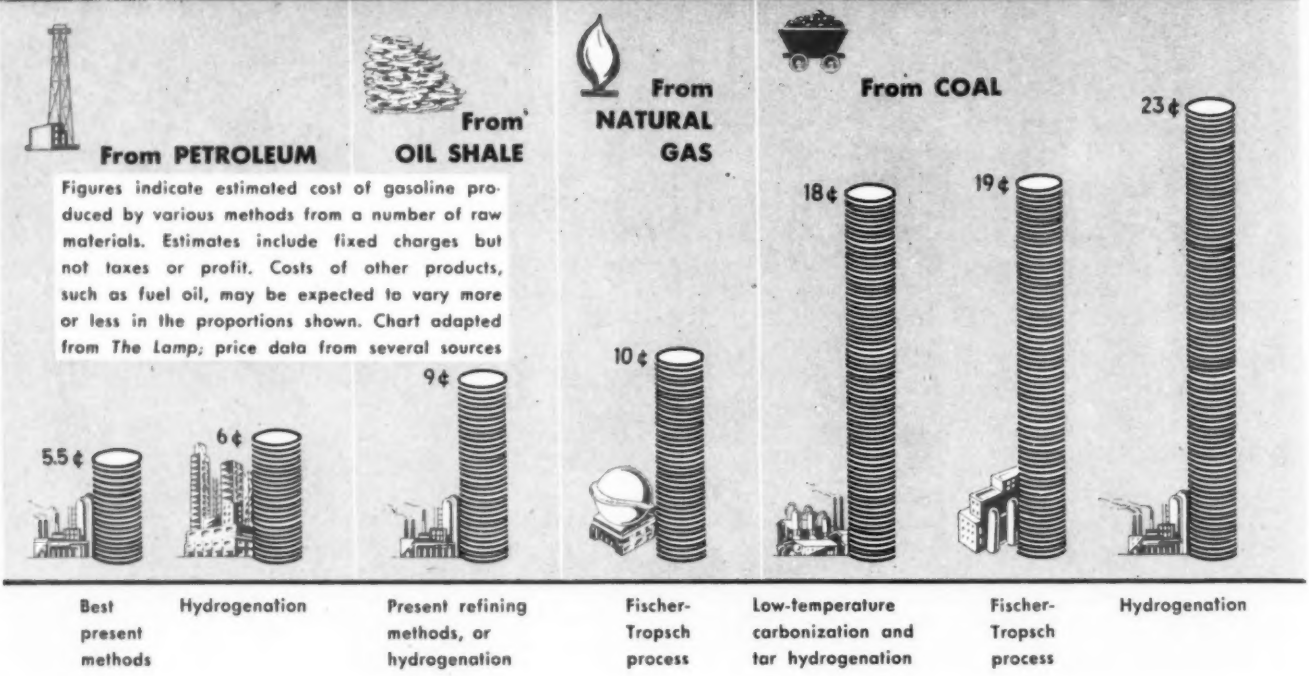
An oil well starts life by flowing free, with underground pressure lifting oil to the surface. This is called *flush* production. Later, pressure falls off and oil must be pumped. As rate of production falls further, the well goes into the *stripper* stage of high-cost marginal operation. That is the end, unless it proves worthwhile to restore underground pressure by pumping in gas or water, called *secondary recovery*. Too high a rate of flush flow wastes pressure, hastens decline and reduces eventual recovery.

Until fighting stops, present record demands will hold. To meet them means (1) operating existing wells at rates somewhat higher than desirable but not damaging (2) drilling new wells to further develop known reserves, and (3) encouraging stripper and secondary-recovery operations. Full use of these methods, plus crude imports and building of foreign refineries to supply overseas demand, will probably see us through. Some naval and military demand will continue for several years after war ends, but total demand will probably fall off somewhat. This will give producers a chance to cut production back to more efficient levels and a price collapse resulting from oversupply is therefore unlikely.

DOUBT regarding future oil supplies grows out of declining reserves and lack of substantial new discoveries, as shown in the charts above, left. These show that reserves failed to increase in 1944 for the first time in ten years and that over the same period average size of new pools dropped sharply, although number of discoveries remaining in production increased.

The chart given here pictures the amount of oil known to be available each year, including in the additions to reserves extensions to existing fields and upward revisions

HOW SUBSTITUTE FUELS COMPARE IN COST


From PETROLEUM
From OIL SHALE
From NATURAL GAS
From COAL
Figures indicate estimated cost of gasoline produced by various methods from a number of raw materials. Estimates include fixed charges but not taxes or profit. Costs of other products, such as fuel oil, may be expected to vary more or less in the proportions shown. Chart adapted from The Lamp; price data from several sources
5.5¢
6¢
9¢
10¢
18¢
19¢
23¢
Best present methods
Hydrogenation
Present refining methods, or hydrogenation
Fischer-Tropsch process
Low-temperature carbonization and tar hydrogenation
Fischer-Tropsch process
Hydrogenation

of recovery estimates. If extensions and revisions are carried back to the year the field concerned was discovered, the chart shows a considerable decline in reserves over the past five years (POWER, Sept, 1943).

EXPLORATION, authorities say, must find 50 to 60 billion bbl of oil in the next 20 years to maintain the ratio of reserves to production. This is more oil than has been found in the 80 years of the industry. That this is possible may be deduced from the map on the preceding page, which shows that sedimentary rock, potentially oil-bearing, underlies much of the U. S. Only a fraction of these areas have been fully explored.

Reviewing discovery history tempers optimism, however. First major discoveries grew out of surface indications, found by hunch or elementary geology. The second and greatest boom followed development of geophysical methods, principally seismography. These methods now seem to have lost most of their value; in areas where they have been used the prominent structures have been mapped.

Geophysicists believe we must depend more and more on locating stratigraphic traps, or erosion areas, rather than definite structures. Such traps can be big producers and may be found virtually anywhere; the difficulty lies in the fact that they give no definite geophysical indications. Drilling must be relied on to give the final answer.

This, coupled with the fact that geologists believe much future oil will be found at depths greater than 10,000 ft instead of 4000 or 5000, means that exploration becomes more risky and expensive. Unless new geophysical tools are invented, it seems fair to say that there is good reason to believe that much oil awaits discovery but that it will probably cost more to find it and bring it to the surface.

Aside from strategical considerations, there is no reason why we cannot draw on nearby Carribbean resources and the reserves of the Near and Middle East, greatest now known. Lower production cost of foreign operations tends to offset transportation and imported crude would not prove unduly expensive.

Strategical considerations undoubtedly account for much of the interest in synthetic fuels. Within our own borders we have more than 90 billion bbl of oil in shale, which can be extracted by known methods. However, experience indicates that crude-oil price would have to rise above $2.00 per bbl before such operations could be justified. An even greater reserve, estimated variously at 150-250 billion bbl, lies in Canada's tar sands, but little is known of extraction methods and costs.

In addition to extracting liquid petroleum from shale and sand, the industry can turn to chemical conversion of the hydrocarbons in natural gas and coal. The Fischer-Tropsch process breaks down gas into hydrogen and carbon monoxide, which are combined catalytically to form synthetic petrolem. A similar process can be used with coal, by far our greatest hydrocarbon reserve.

Now supplying probably half of Germany's petroleum and used on a commercial scale in England, the hydrogenation process uses free hydrogen to change heavy coal hydrocarbons into lighter oil ones. Still another method, low-temperature carbonization and hydrogenation of the resulting tar, can be used. It requires more coal per bbl of oil than other methods but coke is a byproduct. The chart above shows approximate cost of substitute fuels, based on best available estimates. The indication is that if we are willing to pay the price, we can have oil even if crude supplies fail in the distant future.

REFINING progress, accelerated by war, promises to influence supply and price of fuel oils. Catalytic cracking, which will be widely used, gives refiners virtually complete control over relative yields of gasoline, light and heavy oils. This takes fuel oils out of the byproduct class and means that price will be determined largely by the relative profitableness of marketing fuel oils or recycling them for gasoline. The foregoing applies to normal crudes: crudes like those coming from some new Southeast fields prove most suitable for production of fuel oils, and if the supply is abundant the heavy fuel picture might show improvement.

Color Code Identifies Correct Lubricant for Each Bearing

By ROGER M BAKER
Maintenance Superintendent

Practical experience develops a color system that insures lubrication of each bearing with correct oil or grease, simplifies personnel and purchasing problems

► VISUAL COLORS identify lubricant grades, according to their specific uses, in a code, at the right, developed and applied by the author in cooperation with J Clinton Weight, lubrication engineer. Each lubricant is assigned a color, which is painted on all containers and measuring devices in which the lubricant is used. A matching color at every lubrication point insures the proper lubricant for each bearing.

An application-frequency code is used with the color code. The frequency code signifies how often each bearing should be lubricated, such as: every shift, day or week, or only once a year. This color code has helped to keep war-equipment-production machines operating at maximum efficiency in a prominent manufacturing plant and to reduce maintenance costs.

Experience shows that most industrial plants have many lubricants so similar in character and physical properties as to make simplification desirable. Maintenance superintendents tend to follow the lubricant recommendations of equipment manufacturers. This usually means buying lubricants by trade name instead of specifications. If each equipment manufacturer's recommendations were followed, several machines would each call for a different trade-name medium-heavy oil when one would serve the purpose.

The initial step when installing this lubrication color code was to determine the minimum number of lubricants that would take care of the plant's requirements efficiently. Research showed that six oils, three greases and two cutting oils would do the job adequately. Experience shows that the number of

CODE	LUBRICATING CHARACTERISTICS
RED & WHITE	**SPINDLE OIL** (Viscosity 65 to 100 SSU at 100 F) Highly filtered turbine quality for use on high-speed spindles, grinders, etc
WHITE	**LIGHT OIL** (Viscosity 150 SSU at 100 F) Turbine quality for use on small hydraulic systems, pressure circulating or gravity systems, air-line oilers, electric motors, miscellaneous hand oiling
RED	**MEDIUM HEAVY OIL** (Viscosity 300 SSU at 100 F) Turbine quality for use on hydraulic systems, pressure circulating or gravity systems, enclosed baths, electric motors, air compressors, steam turbines, pumps, steam engines, miscellaneous hand oiling
BLUE	**HEAVY OIL** (Viscosity 600 SSU at 100 F) Turbine quality for use as above when a heavier oil is required
ORANGE	**NON-DRIP OIL** (Viscosity 1400 SSU at 100 F) Heavy-body lubricating oil with additives to prevent creeping and dripping; use on shears, presses, or where elimination of drippage on plain bearings is a factor
GREEN	**CYLINDER OIL** (Viscosity 150 SSU at 210 F) Compounded steam-cylinder oil for steam cylinders, gear cases
YELLOW	**BALL- AND ROLLER-BEARING GREASE** (soda-soap base) For use on anti-friction bearings
BROWN	**CUP GREASE** (calcium-soap base) For use as general-purpose grease on bearings other than anti-friction
BLUE / YELLOW	**GEAR GREASE** Grease with metallic fillers and adhesiveness for application on open gears.
WHITE	**SOLUBLE CUTTING OIL**
GREEN / RED	**COMPOUNDED MINERAL CUTTING OIL**

greases can be reduced to two without endangering equipment. The next step in developing the system was to assign a color or a combination of colors to each *grade* of lubricant used. When doing this only primary and secondary colors, or combinations of them, were used to eliminate difficulties resulting from faded or worn colors.

Lubrication Points

After a color had been assigned to each lubricant, all lubrication-application points on each machine were colored according to the *grade* to be used, by painting a disk around each oil hole, grease cup or sight-feed cup. Nothing was left uncoded. Even centralized systems were painted the proper color. Lubrication identification disks are painted about the size of a silver dollar and are readily visible.

Color-spotting the machines eliminates dependence on the memory of the oiler or lubrication engineer for correct lubrication. Each machine's lubrication manual was reviewed to make sure that all points were included. As a result of this study, oil and grease cups were found that apparently had not been used for months. An oiler had been lubricating a machine for several years who, when assigned the duty of coloring its lubrication points, following a chart of that machine, discovered five points that he never knew existed. This was a relatively small machine, but the incident indicates what might happen on large, complicated equipment. It also shows that code colors help insure a better lubrication job.

On most machines a large percentage of lubrication points are easily seen, especially if they are coded with bright colors. Some points are hidden, but a properly colored arrow painted on the equipment indicates location, Fig. 4.

The manufacturer's recommendations were usually followed when selecting a lubricant for each machine. But there were several machines on which the lubricant grade had to be changed, particularly some of the older ones. Sometimes the change was made to compensate for bearing wear, and at other times recent lubricant developments had outmoded the older grades.

After the machines were code colored, every lubrication container, from the original drum to the squirt can, was painted the code color of the lubricant for which it was used. If every piece of equipment is painted the color associated with a given lubricant, there is no excuse for using the wrong oil. Even the operators watch for the correct lubricant to be used on their machines.

As a maintenance superintendent, it has been my practice to separate lubrication of electric motors from production-machinery lubrication. It is my opinion that lubrication of electric motors should be done by a competent electrician rather than by plant oilers.

A color code simplifies purchasing and storage of lubricants. The system functions from either lubrication specifications or a list of all lubricants that meet the color classifications. If a specification is used, a requisition may call for a quantity of RED oil. The purchasing agent looks at the specification for RED oil and buys any oil that falls within its requirements. By this system, oil vendors quote against specifications rather than a competitor's product.

When a large company having several plants uses a color code, all lubricants can be purchased by a central purchasing department and sent to the various plants as requested. Bulk purchasing saves considerable in operating costs.

When preparing lubrication specifications take care not to make them too involved. A simple method lists all acceptable lubricants that meet the color-code requirements. If there are ten oils acceptable as RED, it lists them with the purchasing department for that grade.

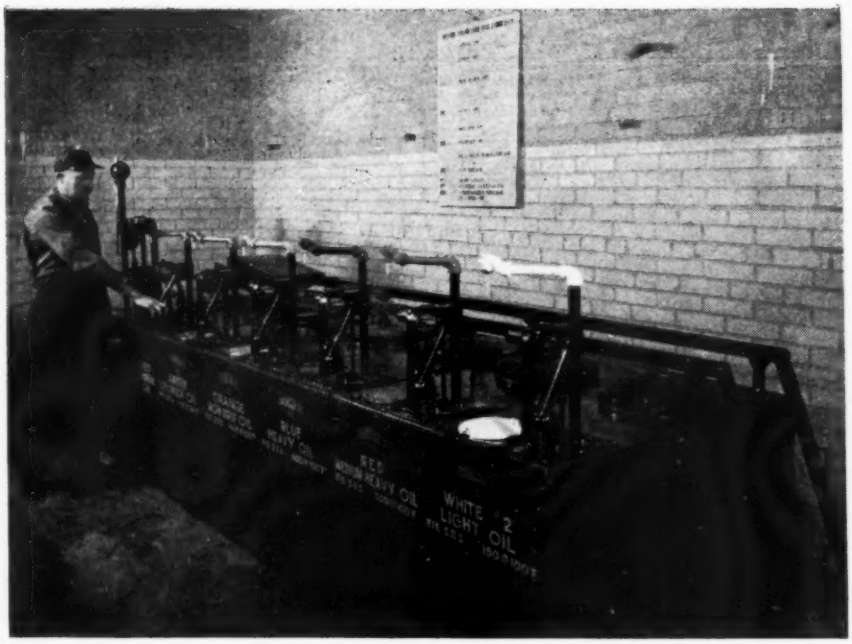


Fig. 2—Each oil-storage tank has its nozzle and cover painted a code color corresponding to the oil it contains and a color chart shows where the oil is used

Photos courtesy of Allentown, Pa. Division, Consolidated Vultee Aircraft Corp

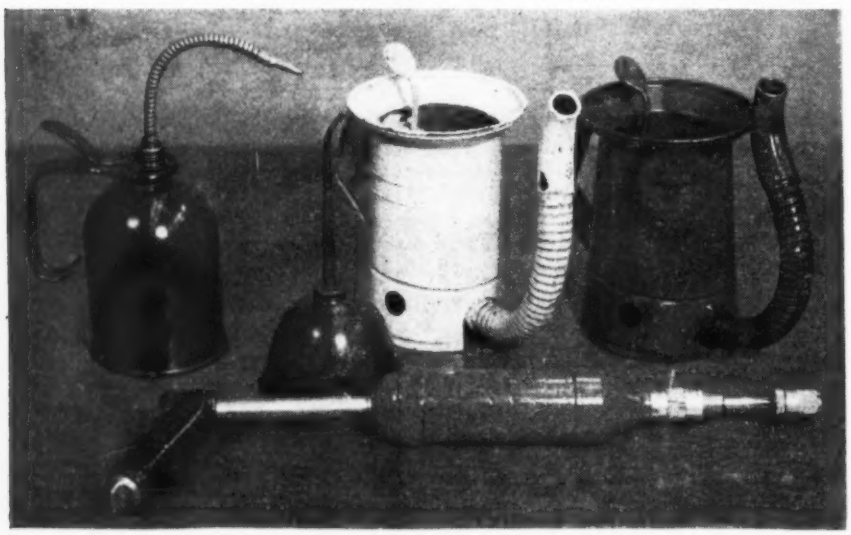


Fig. 1—To prevent mistakes each lubricant-dispensing container, oil can or grease gun is painted the identifying color of the oil or grease it is to contain

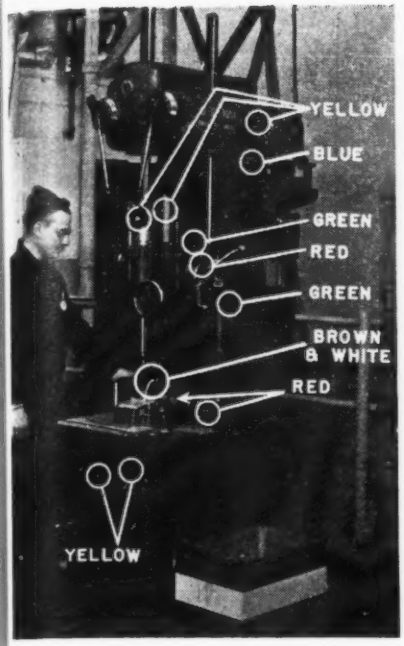


Fig. 3—All lubrication points on this drill press are color-code identified

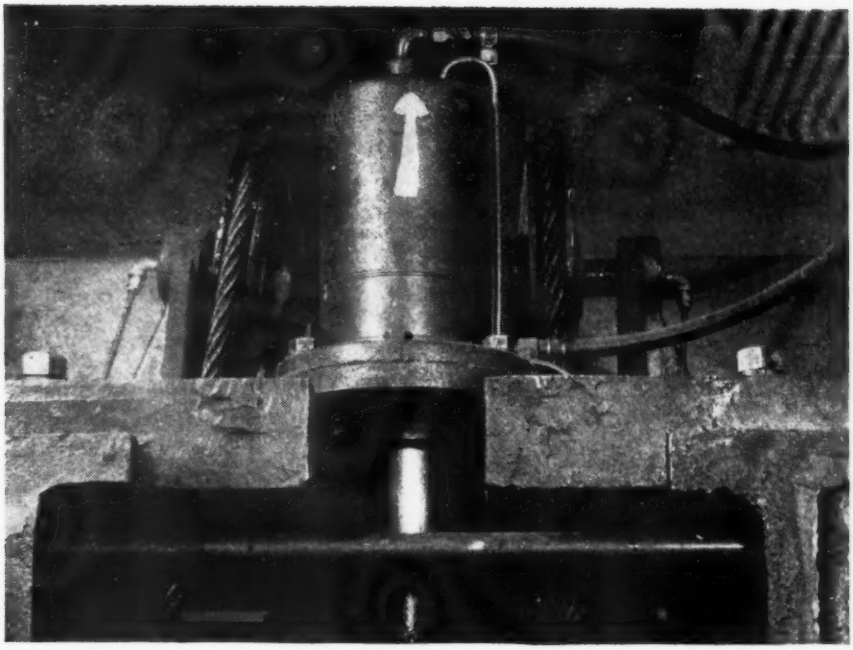


Fig. 4—When lubrication points are not easily seen an arrow painted the oil-identifying color points to the concealed location and shows the kind of oil to use

When the purchasing agent gets a requisition for RED oil, he buys any one of the ten oils listed under that color. This system is used at the plant where I developed the color code and has proved practical.

Either system permits the purchasing agent to exercise his judgment and make the best buy at a certain time. When a requisition for a definite oil is sent to the purchasing department and it is not available within the delivery period specified, if the oils are coded, the purchasing agent may get immediate delivery of another on the list that serves the purpose equally well. Either system keeps oil dealers alert and prices within comparable ranges and in this respect there is little choice between the color code and specifications. Intelligently developed and applied, the color code is adaptable to any industrial plant.

Any workman, unless he is color blind, can do a creditable lubrication job with minimum instruction and supervision when a color code is used. The more highly trained personnel are thus available where higher skills are required. Code colors also permit oilers to be transferred from one plant section to another without further training, once they have learned the system.

The most important thing an oiler must learn is the lubricant quantity to be used. After that, he gets RED or other color oil, depending on the application, from a metering tank, using a RED dispensing unit, and puts the proper amount of this oil in each RED oil cup as he goes up one row of machines and down another.

(*Continued on page* 208)

Check These 14 Ways to Save Paper on the Job Now!

Every Little Scrap of Paper Is Needed for the Big Scrap

In correspondence:

1. Have carbons of replies typed on the backs of letters. Thus avoid loss of carbons, save file space, and save paper.

2. Have old letterheads and other stock, used on one side, padded for scratch pads, memos, interoffice notes, etc.

3. Reduce typing margins; eliminate double-spaced replies.

4. Use half-sized letterheads and small envelopes for short letters.

5. Stop acknowledging acknowledgments—study shows that half or more of business correspondence is unnecessary.

6. Be brief—think before you dictate—and save time and paper.

7. Scrap obsolete forms; reduce forms; reduce carbons.

8. Use postcards when they'll do the job.

In office routine:

9. Prune files—scrap obsolete catalogs, booklets, bulletins, clippings, old magazines, etc.

10. Clip wanted material from technical or business magazines; salvage the rest—and the space they take.

11. Don't crumble or tear up direct mail or used office paper—assemble and salvage it.

12. Suggest or provide containers for used paper; salvage newspapers, bags, cartons, packing, etc.

In drafting rooms:

13. Ferret out and salvage obsolete catalogs and "dead" files.

14. Salvage spare and obsolete blueprints and specifications.

THE PAPER THAT YOU SAVE TODAY FIGHTS TOMORROW

Calculating Pipe Flow For Large Pressure Loss

Rational method for determining flow conditions of an elastic fluid such as air or steam in a pipeline where a large change in specific volume occurs. Numerical example illustrates procedure for those whose mathematics is rusty

By WALTER C WOODMAN, *Stone & Webster Engineering Corp*

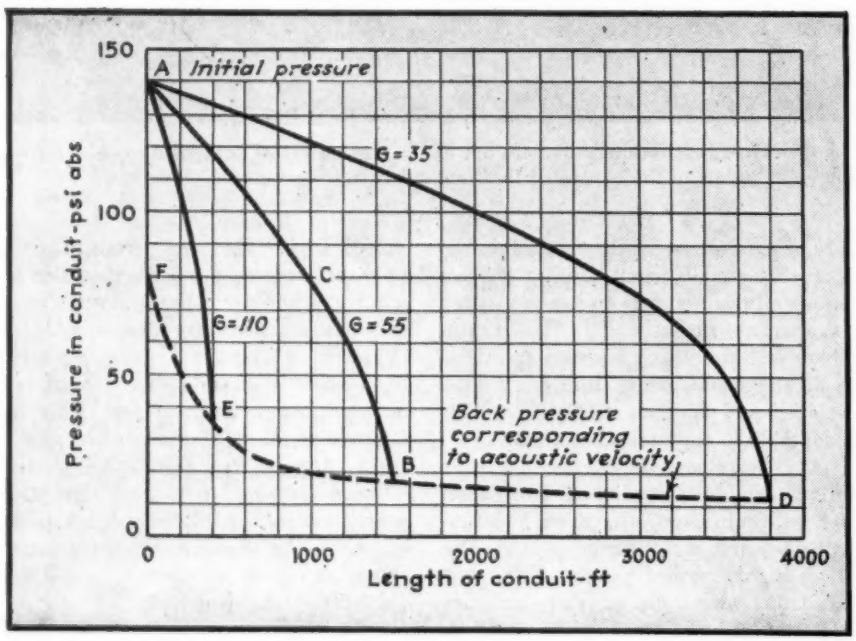


Fig. 1—Several typical curves of pressure loss. Curve *AB* represents the maximum flow a particular conduit 1500 ft long will pass with an initial pressure of 140 psi. A pressure drop of 120 psi results. At point *B* the pressure at the end of the conduit has reached the lowest possible value without the velocity exceeding that of sound in the fluid, the acoustic velocity, and flow in the pipe is a maximum

► PRESENT RATIONAL METHOD for determination of pressure loss in pipelines has been developed over a period of 30 years and much has been published on the subject.* It was long ago demonstrated that test data for pressure drop of a great variety of fluids and conditions of flow could be lined up and expressed as a single set of friction factors when plotted against the dimensionless parameter, customarily called Reynold's Number.**

Practically all published material (and most actual cases) assume the usual condition where pressure loss of an elastic fluid is a small percentage of the inital pressure. Very little has been printed on the solution of the problem which arises when large changes in pressure and specific volume take place between the beginning and end of a pipe or conduit.

An attempt to solve the latter problem by employing the usual relation-

* "Chart for Finding Pressure Drop in Steam Piping," by W C Woodman, POWER, Aug. 27, 1929. "Direct Solution for Pipe Capacity," by J R Zwickl, POWER, March, 1940.

** By dimensional analysis it has been demonstrated that the friction factor f is a function of dimensionless parameter to which the name Reynold's Number is usually given: $\frac{dV\rho}{Z}$ or $\frac{F}{dZ}$ where d is diameter of pipe in ft, V is velocity of fluid flow fps, ρ is density in lb per cu ft, Z is absolute viscosity of the fluid in lb per ft sec and F is fluid flow in lb per sec. Most up-to-date treatment of pressure-loss problems in pipelines follows this rational method of determining friction factor. See Kent's *Mechanical Engineers' Handbook*, pages 4-57 to 4-60.

TABLE I— GENERAL EQUATIONS

(1) $$h = \frac{4 f L V^2}{2 g d} = \frac{2 f L V^2}{g d}$$

where h = head loss in ft of fluid
f = friction factor, dimensionless
L = length of conduit, ft
V = velocity of fluid flow, fps
g = acceleration of gravity, ft per sec²
d = diameter of conduit, ft

(2) $$h = \frac{p_1 - p_2}{\rho}$$

(3) or $$h = (p_1 - p_2)v$$

where p = pressure, lb per sq ft
ρ = density, lb per cu ft
v = specific volume, cu ft per lb

Combining (1) and (3)

(4) $$p_1 - p_2 = \frac{2 f L V^2}{g d v}$$

(5) $$P_1 - P_2 = \frac{0.0000134 f L F^2 v}{D^5}$$

where $P_1 - P_2$ = pressure drop, psi
f = friction factor
L = length, ft
F = flow of fluid, lb per hr
v = specific volume, cu ft per lb
D = diameter, in.

(6) $$h_1 - h_2 = \frac{1}{2 g \times 778} (V_2^2 - V_1^2)$$

where h = total energy of fluid, Btu per lb
V = velocity of flow, fps

Since weight flow and area of conduit are constant, the equation of continuity may be used:

(7) $$W = \frac{V A}{v}$$

where W = weight flow, lb per sec
A = area of conduit, sq ft
v = specific volume of fluid, cu ft per lb

Letting G represent constant ratio $\frac{W}{A}$

(8) $$G = \frac{V}{v}$$

And substituting in (6)

$$h_1 - h_2 = \frac{G^2}{2 g \times 778} (v_2^2 - v_1^2)$$

Between the beginning of the conduit and any point x, if the initial velocity $V_o = 0$, the above may be written:

(9) $$h_x = h_o - \frac{G^2 v_x^2}{2 g \times 778}$$

(10) $$\int_{p_1}^{p_2} \frac{dp}{v} + \frac{G^2}{g} \log_e \frac{v_2}{v_1} + \frac{2 f G^2 L}{d g} = 0$$

(11) $$V_c \sqrt{g p v \lambda}$$

where V_c = critical velocity, fps
g = acceleration of gravity, ft per sec²
p = pressure, psi
v = specific volume, cu ft per lb
λ = exponent in the expression for adiabatic expansion: $p v^\lambda = C$
For air, $\lambda = 1.41$
For superheated steam, $\lambda = 1.3$
For wet steam, $\lambda = 1.035 + 0.1 X$

ships (which assume no change in specific volume and that the pressure in the receiving vessel, or atmosphere, will exist in the end of the pipeline) will result in considerable error. This article outlines a rational and logical procedure for determining flow of a fluid undergoing a large change in pressure and specific volume in a conduit or any kind of piping system.

For convenience, the necessary formulas are grouped in Table I, and a numerical illustrative example is worked out in Table II. For the latter, specific test conditions were assumed so that a check between calculated and measured values could be plotted, as in Fig. 2.

Referring to Table I, the general relationship for pressure loss accompanying the flow of a nonelastic fluid (liquid) in a circular, closed conduit is given in formula (1). This will be recognized as the Fanning equation in which some writers omit the "4" in the numerator so that their expressed values of friction factor f are four times as great as those here used.

While expression (4) applies to a liquid, it is sufficiently correct when used to determine pressure drop of an elastic fluid (compressible gas or vapor) provided the change in pressure is such as to cause only a small change in specific volume of the fluid. That is, for small pressure drops, say not more than 10% of the initial pressure, expression (4) is usually sufficiently accurate. This same relationship is equally applicable to a fluid in either its liquid or its vapor phase, or to a mixture of the two, provided the change in specific volume is small.

Equation (5) expresses equation (4) in ordinary English engineering units. Note that certain of the units in this expression differ from those used elsewhere in this article.

If the expansion of the fluid in the conduit can be considered adiabatic, (negligible quantity of heat lost by conduction through the walls of the conduit) the expression for an adiabatic expansion with no external work done may be written as expression (6) of the general equations in Table I.

By the substitutions (7) and (8) the general equation for total energy of the fluid at any point x in the line can be written (9). For a given conduit flow and initial conditions of the fluid, G, h_o, v_o, and p_o (subscript $_o$ denoting initial conditions) are all known.

Various values of v_x (specific volume at some point in the line) are then assumed greater than v_o to correspond with expansion of the fluid at various points along the conduit and h_x calculated from (9). The state point of the fluid is then wholly determined and the corresponding pressure, p_x can be read from a chart or table. Pressure drop between inlet and each of the assumed points in the line will be $p_o - p_x$.

Since nothing has yet been introduced in regard to any law of friction, it is unknown in what *length of conduit* this expansion has taken place. A relation between pressure, specific volume and friction is supplied by (10).

To Find Conduit Length

It may be noted that, for constant or nearly constant specific volume, the first term of equation (10) becomes $(p_2 - p_1) \div v$ and the second term disappears and the whole expression (10) reduces to the equivalent of (4).

From equation (10) the length of conduit in which expansion takes place to pressure p_x, as found from equation (9), can then be calculated. Use of equations (9) and (10) thus permits a complete determination of the state of pressure along the entire length of the conduit, as illustrated in Fig. 1.

Curve AB represents the maximum flow a particular 1500-ft conduit will pass with an initial pressure of 140 psi. At point B, the pressure has fallen to 20 psi, the lowest possible value without the velocity exceeding that of sound in the fluid, *the acoustic velocity*. If the conduit discharges into a receiver (or the atmosphere) in which pressure is

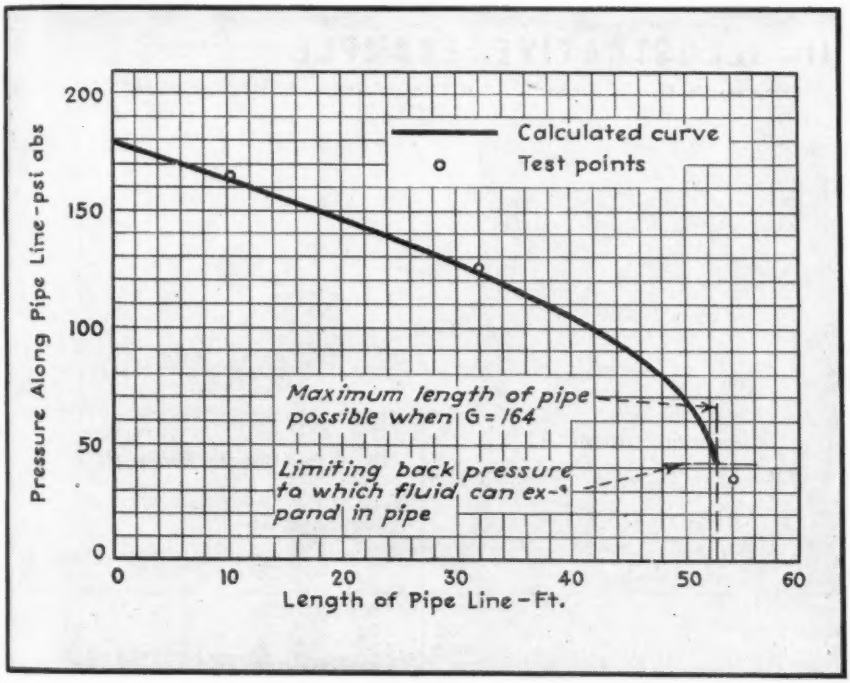


Fig. 2—Comparison of calculated curve with test points based on data from point No. 6 "Compressible Flow of Steam," by J H Keenan, ASME Trans, Dec 1938

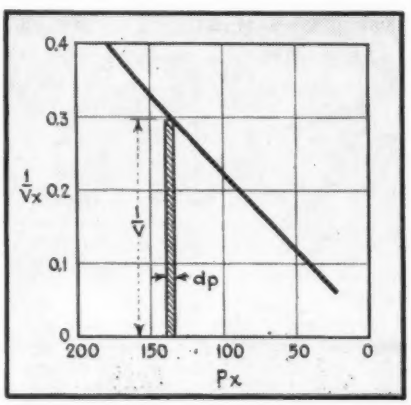


Fig. 3—Graphical integration of factor A of illustrative example plotted from calculations in Table II, page 84.

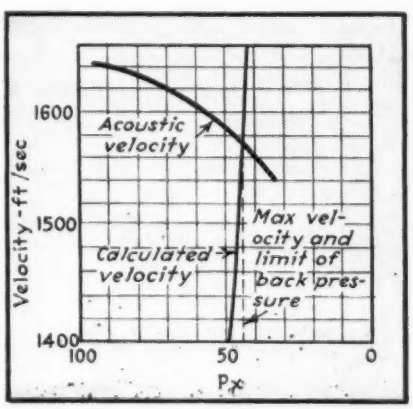


Fig. 4—Intersection of calculated-velocity and acoustic-velocity curves determines limit of backpressure

less than 20 psi, no increase in flow results.

Still referring to Fig. 1, if a point such as C were the terminus of the conduit, the same flow ($G=55$) would pass through the conduit to discharge against a backpressure of 80 psi, but the maximum possible length of conduit under these conditions would then be only 1000 ft. Curve AD indicates the conditions existing with a lower flow or larger pipe such that $G=35$, resulting in a longer possible pipeline; curve AE illustrates a condition of greater flow or smaller pipe. A curve drawn through the terminal points of these pipelines, DF, is the locus of the backpressures corresponding to the acoustic velocities; it terminates at zero length (orifice) in a value equal to 0.57 of initial pressure.

Of the several means which might be employed to determine the critical or acoustic velocity at the end of the pipeline, one of the simplest is given in equation (11). If curves of the apparent calculated velocity V_x for any given set of conditions and the critical velocity V_c are plotted against pressure p_x, the intersection will be the minimum, or critical pressure, below which the fluid cannot expand while in the pipe.

Unlike the simple case using only equation (5) in which any factor can be solved for as the unknown, the determination of large pressure drops is too complex to permit a direct solution. It will usually be necessary to assume a pipe size and then determine whether the calculated pressure drop and length of pipe are compatible with the given conditions.

In the majority of cases one can proceed as follows:

1. W is known or assumed
2. Assume d and calculate A
3. Calculate $G = W \div A$
4. Values of p_o, t_o, v_o, h_o, and V_o are known ($V_o = 0$, usually)
5. Assume a series of values for v_x
6. Calculate h_x from (9)
7. From tables read value of P_x. Charts having constant-specific-volume curves are useful for this step

(*Continued on page* 210)

TABLE II—ILLUSTRATIVE EXAMPLE

(Based on test data from Point No. 6 – "Compressible Flow of Steam"– J H Keenan, Trans ASME, Dec, 1938)

Data: $p_0 = 178$ psi, abs $v_0 = 2.50$ cu ft/lb $T_0 = 387$ F $h_0 = 1204.5$ Btu/lb Receiver press = 12.8 psi

Flow = 58.07 lb/min = 0.968 lb/sec $D = 1.04$ in. = 0.0867 ft $A = 0.00590$ sq ft

$$G = \frac{\text{Flow}}{\text{Area}} = \frac{0.968}{0.00590} = 164 \qquad f = 0.00374$$

General formula for solution:

$$-\int_{p_1}^{p_2} \frac{dp}{v} + \frac{G^2}{g} \log_e \frac{v_2}{v_1} + \frac{2fG^2L}{Dg} = 0$$

This is of the general form: $-A + B + C = 0$

Where: $A = \int \frac{dp}{v}$ $B = \frac{G^2}{g} \log_e \frac{v_2}{v_1} = \frac{(164)^2}{32.2} \log_e \frac{v_2}{2.50} = 835 \log_e \frac{v_2}{2.50}$ $C = \frac{2fG^2L}{Dg} = \frac{2 \times 0.00374 \times (164)^2 L}{0.0867 \times 32.2} = 72.1L$

Calculation of h_x from relation:

$$h_x = h_0 - \frac{G^2 v_x^2}{2g \times 778} = 1204.5 - 0.537\, v_x^2$$

v_x	v_x^2	$0.537\, v_x^2$	h_x	p_x (from chart)
2.50	–	–	–	178.0
3.00	9	4.8	1199.7	153.0
4.00	16	8.6	1195.9	112.0
5.00	25	13.4	1191.1	89.0
6.00	36	19.3	1185.2	74.0
7.00	49	26.3	1178.2	62.0
8.00	64	34.4	1170.1	53.0
10.00	100	53.7	1150.8	42.0
12.00	144	77.4	1127.1	33.0
14.00	196	105.0	1100.0	28.0
16.00	256	137.0	1068.0	23.0

Solution for factor A:

$$A = \int \frac{dp}{v} = \sum \frac{1}{v_{avg}} (p_1 - p_2) = \frac{\frac{1}{v_1} + \frac{1}{v_2}}{2} (p_1 - p_2) \times 144$$

(Plotted in Fig. 3)

v_x	$1/v_x$	$\frac{1}{v_1} + \frac{1}{v_2}$	$\frac{1}{2}\left(\frac{1}{v_1} + \frac{1}{v_2}\right)$	p	$p_1 - p_2$	$\int \frac{1}{v} dp$
2.50	0.4	–	–	178	–	–
3.00	0.333	0.733	0.367	153	25	1320
4.00	0.25	0.650	0.325	112	66	3090
5.00	0.20	0.600	0.300	89	89	3850
6.00	0.167	0.567	0.284	74	104	4250
7.00	0.143	0.543	0.272	62	116	4550
8.00	0.125	0.525	0.263	53	125	4730
10.00	0.100	0.500	0.250	42	136	4900
12.00	0.083	0.483	0.242	33	145	5050
14.00	0.072	0.472	0.236	28	150	5100
16.00	0.063	0.463	0.232	23	155	5180

Solution for factor B:

$$B = 835 \log_e \frac{v_x}{2.50}$$

v_x	$\frac{v_x}{2.50}$	$\log_e \frac{v_x}{2.50}$	$835 \log_e \frac{v_x}{2.50}$
2.50	1.0	0	0
3.00	1.2	0.182	152
4.00	1.6	0.470	392
5.00	2.0	0.693	578
6.00	2.4	0.875	731
7.00	2.8	1.030	860
8.00	3.2	1.163	971
10.00	4.0	1.386	1160
12.00	4.8	1.568	1310
14.00	5.6	1.723	1440
16.00	6.4	1.856	1550

Solution for factor C:

$A + B + C = 0$ (since p decreases as v increases)

$C = 72.1\,L$ $L = \frac{A - B}{72.1}$

p_x	v_x	$A - B$	$\frac{A-B}{72.1}$ = Length in feet
178	2.50	0	0
153	3.00	1170	16.2
112	4.00	2700	37.5
89	5.00	5270	45.4
74	6.00	3520	48.9
62	7.00	5690	51.2
53	8.00	3760	52.2 ※
42	10.00	3740	51.9 ※
33	12.00	3740	51.9
28	14.00	3660	50.8
23	16.00	3630	

※ *Higher values are fictitious - See text*

Solution for acoustic velocity (Plotted in Fig. 4)

v_x	p_x	h_x	Δh ($h_0 = 1204.5$)	$225\sqrt{\Delta h}$	$V_c = \sqrt{gpv\lambda}\ (\lambda = 1.3) = 6.46\sqrt{pv}$
2.50	178	1204.5	0	0	–
3.00	153	1199.7	4.8	495	–
4.00	112	1195.9	8.6	660	–
5.00	89	1191.1	13.4	824	1640
6.00	74	1185.2	19.3	989	1625
7.00	62	1178.2	26.3	1150	1605
8.00	53	1170.1	34.4	1320	1595
10.00	42	1150.8	53.7	1650	1570
12.00	33	1127.1	77.4	1980	1535
14.00	28	1100.0	104.5	2300	1520
16.00	23	1068.0	136.5	2620	1490

Wartime Maintenance of Diesel Valves and Gear

For efficient combustion and reliable operation, keep valves and gear in good shape and proper adjustment. Here are practical pointers on mechanical inspection and tuneup that will make this part of the maintenance routine easier

By G H MENEFEE
Chief Machinist Mate, USNR

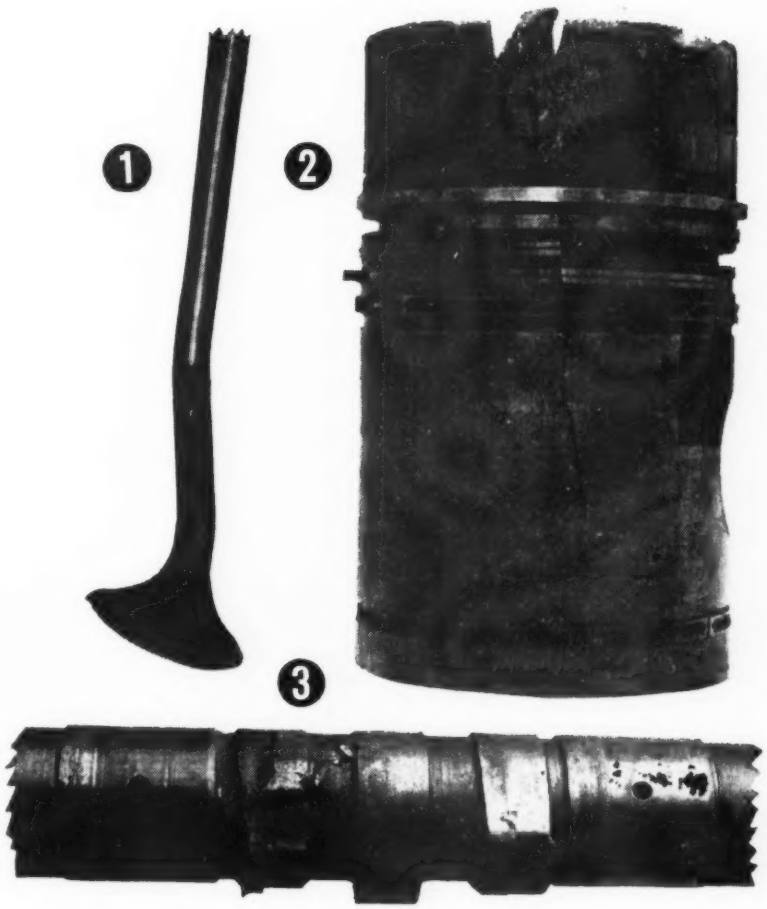


Fig. 1—Proper lubrication of guide and stem would have kept this valve from sticking and bending the stem. Fig. 2—Insufficient valve clearance wrecked this engine. The piston hit the valve and broke it off. On the next stroke, the valve split the piston and caused it to seize, pulling the connecting-rod bolts apart. The crankpin hit the connecting rod, knocking it through the cylinder block and ruining it. Notice valve sticking in piston crown. Fig. 3—Stoppage in a lube-oil supply line ruined this camshaft, and the followers and camshaft bearings as well

▶ PROPER ADJUSTMENT and maintenance of diesel-engine valves and valve gear is of the utmost importance because efficient combustion depends in large measure upon their satisfactory operation. The wise operator makes inspection and reconditioning of these parts a feature of his routine, rather than leave the job for periods of major overhaul. Although the work connected with valve-gear maintenance is neither highly involved nor laborious, it must be carried out regularly and thoroughly. Lack of such routine care soon leads to complications that are direct causes of major engine troubles.

Improper valve operation is easy to spot. In fact, it is so easy that there is no excuse for an operator who fails to keep valves and gear in top condition. Heating of the air-starting line in the vicinity of the valve, when the engine is running, indicates air-starting-valve leakage. To check tightness of cylinder-relief valves, hold a lighted match near the valve; the flame flickers if there is a leak. Late closing of the exhaust valve causes soft carbon deposits in the intake passages. This can also be caused by early opening of the inlet valve.

Checking Exhaust

If pyrometer readings show excessively high temperatures in the exhaust line, look for exhaust valves that open too early. The trouble could also be caused by a leaking injection valve or injection of too much fuel. Checking the exhaust through an inspection port eliminates these latter possibilities. If there is no such port in the exhaust line, it is well worth the trouble of installing, even if it is necessary to cut through a water space. If the exhaust valve is at fault, flame shows when the exhaust opens. Detonation heard in the exhaust passage when ignition occurs indicates late closing of the exhaust valve, whereas early closing causes a whipping noise in the intake line. Improper operation of any valve results in power decrease and lower engine efficiency.

Rocker-arm troubles are rare and almost entirely confined to wear in the rocker-arm bushings, which usually receive lubrication from a separate line to the drilled rocker-arm shaft. Because service is not severe, examination of rocker arms and bushings may be left until time of major overhaul, unless trouble shows up before. During overhaul, clean rocker arms with kerosene or fuel oil and examine for cracks. Check bushings for wear, which should not exceed about 0.001 in., per in. of

diameter. If the manufacturer specifies wear limits, use them in preference to the above general rule. In either case, replace bushings showing more than allowable wear.

Check rocker-arm shaft for roundness and wear. If it is scored or out of round, turn the shaft down and fit new bushings to match. Clean oil holes and passages thoroughly with a carbon solvent and blow out with air.

At major overhauls, disassemble the roller on the rocker arm and the roller pin, and check for wear. Remove flat spots on roller or pin; failure to do so causes the roller to stick and thus wears the cam excessively. Heavy wear or excess clearance of cam followers or rocker-arm bushings make it impossible to time the engine accurately.

Inspecting Cam Followers

Cam followers should be checked for wear both on the inside where the push-rod rides and on the outside where the follower rides in its guide. These parts usually receive ample lubrication and wear little, so failure is rare. However, some followers have springs and these fail more frequently. Clean springs carefully in a carbon solvent and examine for cracks or breaks. Change the spring if it is damaged or if its free length is shortened to any degree.

On common-rail engines, examine wedges between cam follower and push-rod for wear, or flat spots. These wedges receive quite a bit of hammering and will, in time, develop flat spots which prevent proper fuel metering. Remove flats by grinding smooth, or replace the wedge. If wedges are ground, take care not to remove too much material and grind all wedges at exactly the same angle. After grinding, caseharden top and bottom surfaces.

During major overhaul, remove the camshaft and examine cams for wear. Center the shaft in a lathe and check for straightness. Wash oil passages with kerosene and blow them out. Inspect bearing surfaces for wear and scoring; if scoring is found, remove it by careful stoning. Make sure that bolts on adjustable cams are tight and that the cams have not slipped. Replace worn detachable cams or the entire shaft when cams are integral. Adjust slipped cams approximately and make final adjustment when engine is timed.

Check camshaft bearings for wear and replace if the normal clearance of about 0.002 in., per in. of diameter, has increased to more than 0.003 in. per in. If bearings are of the bushing type, support the camshaft carefully as it is drawn through them and handle carefully to avoid scoring.

Inspect the camshaft gear and all gears in the timing train, looking for worn or broken teeth and for wear in bearings of idler gears. Replace gears with worn or broken teeth. To check gears for backlash, hold a piece of soft lead wire against the rear side of a tooth and turn the gears past their contact point. Wire thickness measures backlash, or clearance between teeth. Check this clearance at several points on each gear. It should run about 0.006 to 0.008 in. and gears should be replaced when clearance has increased about 75%. Mark timing gears carefully by center punching the teeth before gears are removed so that they may be reinstalled in proper position.

When removing valves for inspection, examine valve keepers for wear and replace if damaged. Keepers are subjected to considerable strain and are liable to wear so that they break or slip out of place while the engine is running, permitting the valve to drop into the cylinder. If no replacements are handy, keepers may be made from key steel. Also examine spring retainers for wear and cracks. Failure of these parts is rare, but if it does occur it is likely to cause serious trouble.

Check valve springs whenever valves are removed. Inspect them carefully for cracks in the coils and for splitting. Measure springs for tension if a spring tester is available. If necessary, a tester can be made easily. Also check springs for foreshortening and make sure they have not taken a set out of the proper plane. Since damaged springs cannot be repaired satisfactorily, replace them.

Check valve guides for wear, and for chipping on the lower end. The clearance usually given runs about 0.004 in., per in. of diameter. Change guides when wear increases clearance to 0.006 in., per in., or when they are broken. Clean guides with an expanding cleaner, which may be made by attaching small flat strips of steel lengthwise to a rod around its periphery. Strips should be spring steel, bowed in the middle. Guides may also be cleaned with a small, stiff wire brush.

Exhaust-Valve Servicing

Inspect exhaust valves on high-speed engines about every 500 hr of operation, and inlet valves about half as often. On slow-speed engines, these intervals may be extended. Check the valve seat for pitting and burning and the stem for straightness. To determine straightness, place the stem in a pair of V-blocks on a surface plate, as shown in Fig. 4. The dial indicator setup pictured will reveal any lack of straightness when the valve is rotated. Bent valves may sometimes be straightened by tapping the high point with a babbitt hammer, but if spares are available replacing is preferred.

Check the valve for warping if there

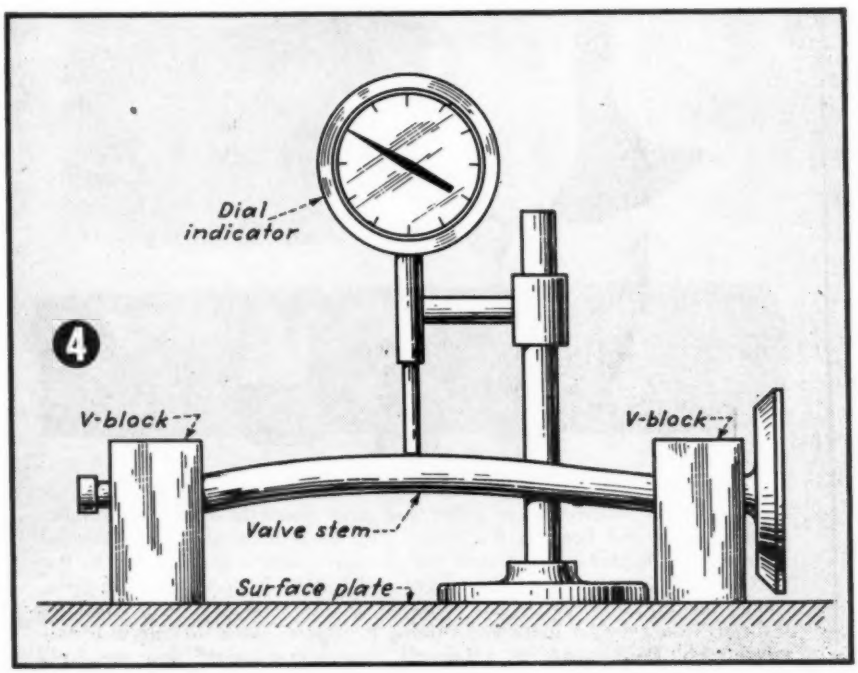


Fig. 4—With the valve stem laid in V-blocks on a surface plate and rotated slowly, use of a dial indicator shows clearly any slight lack of straightness in stem

is any indication of leaking. This may be done by placing the indicator point against the seating surface while the valve stem rests in the V-blocks. Warped valves usually have to be discarded, but they may be salvaged if the face can be cut true in a lathe without undue weakening.

If there is indication of leaking or if pitting is found, reseating is necessary. Refacing before reseating usually saves time and work. If valves are scaled, remove scale with a file before refacing as the scale is hard enough to ruin even a good lathe tool in a short time. After filing, center the valve in a lathe, or better yet, in a valve-grinding machine. Take as fine a cut as possible off the valve face, just enough to give an entirely new surface.

After the valve has been replaced, reseat it in the head or valve cage. If a cage is used, make sure it is securely bolted in the head, or in a jig, before the valve is seated. This gives the valve a seat conforming to any distortion that may occur when the cage is tightened in the head. Coat the valve with medium-grade grinding compound, and oscillate it while applying slight pressure. Lift the valve occasionally to give the compound a chance to spread evenly.

Check seat tightness by making marks across the valve face with a soft lead pencil and turning the valve less than one revolution while pressing it against the seat. If seat is tight, pencil marks will be erased in a fine line around the valve face. Fig. 5 shows what happens when a valve is reseated excessively; this condition prevents proper gas flow when valve is open. Replace a seat in this condition. If valve seat is made of special steel, it wears a groove in the valve face if reseated excessively.

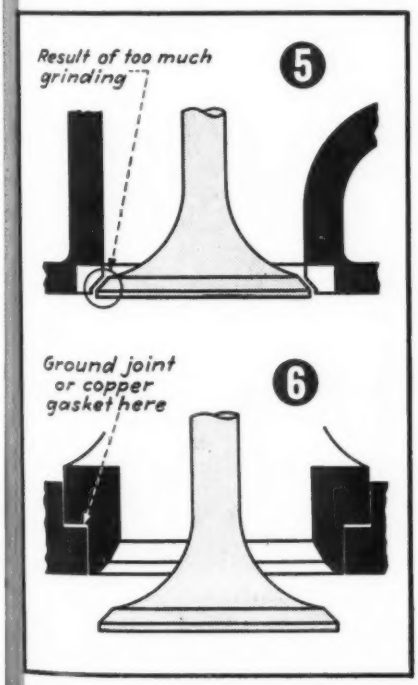


Fig. 5—Results of excessive reseating
Fig. 6—Usual seating of cage in head

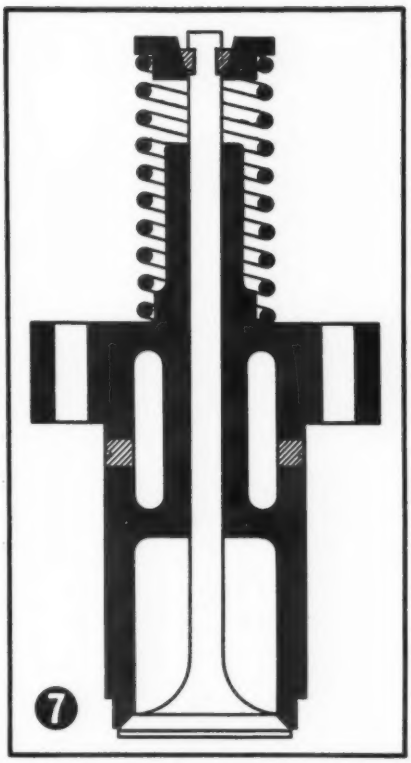


Fig. 7—Cross-section of a typical water-cooled cage for a diesel exhaust valve

Because duty is less strenuous, intake valves require less attention than exhaust. This means that longer intervals between inspection and reconditioning are permissible, but the actual operations follow the procedures outlined for exhaust valves.

Fig. 6 shows how the typical valve cage seats in the head. The space indicated by the arrow should be cleaned and examined carefully, as it is at this point that most leakage occurs.

Because relief valves get little use they usually require little attention. However, when they are needed, they are really needed, and the careful engineer will make sure that they are always in good shape. This means dismantling, cleaning and inspecting at every major overhaul. It is also a good idea to check relief-valve operation once a week by causing valves to lift. This may be done by accelerating the engine suddenly. Those that fail to operate properly under this test should be removed at once for inspection.

Although rare, air-starting-valve troubles may lead to serious difficulties if neglected. Such troubles usually take the form of the valve sticking in open position, which prevents the engine from starting. Cleaning the valve is the obvious remedy. Heating of the starting-air line near the valve when the engine is running indicates leakage, and when the engine is shut down starting-air bottles will lose pressure. Starting-air valves should be removed for inspection during major overhauls.

Fig. 7 shows a typical watercooled exhaust-valve cage. Whenever valve is removed, clean and inspect water spaces. Do not remove core plugs unless it proves necessary and then coat them with graphite before reinstalling.

After overhaul, or when made necessary by valve mechanism wear, valves must be retimed. On most engines, flywheel marks show dead center and valve events; if not, dead center must be found as described in POWER, June, 1943, p 86. Always turn flywheel in the direction of rotation and if it goes past the mark, make a full turn to bring it around again. Reversing rotation introduces timing-gear backlash. Use feelers to measure tappet and cam-roller clearance. For extreme accuracy, a dial indicator may be used to show the first signs of valve lift. However, for ordinary checking on inlet, exhaust and starting-air valves, it is enough to note when all clearance is taken up and it is no longer possible to turn cam rollers with the fingers, or when the stem can no longer be rotated by hand.

Coal-Mine Manpower A Critical Problem

Average age of miners has increased 13 years during the war—from 32 to 45—and their number has decreased by 56,000 since 1942. SFA explains that the increased age and decreased numbers are among the reasons why there may be a shortage of coal this winter.

Loss of the younger men is most keenly felt in the mechanized mines where production is higher. Production per man in the bituminous mines averaged 1500 tons last year, an all-time high. Anthracite average was 750 tons. Strip mining has been stepped up since the war because such mines can produce the same tonnage per day with one-third to one half the manpower of a deep mine. However, most strip mines are in fields that produce the less critically needed coals.

Low-Cost Hookup Deaerates Drips Only

System cuts deaerator investment in half, yet insures thorough deaeration of primary sources of oxygen contamination

By E B KUHN
Heat Transfer Department
Elliott Company

▶ A COMPROMISE BETWEEN full deaeration and none at all, the heat-balance system in Fig. 1 is the first hookup of its kind as far as we can determine. It offers an interesting solution of the oxygen-contamination problem, using an all-closed-heater cycle with deaerating equipment for drains and makeup.

Controlled positive pressure in the deaerator insures good results in this heat-balance system, which has performed satisfactorily since its installation in a large Middle West utility company station two years ago.

Water is taken from the main condenser hotwell through the air-ejector inter- and aftercondenser to a low-pressure first-stage heater, then through the second stage heater (or closed heater), then into suction of the boiler-feed pump.

The vent condenser of the Elliott deaerator is connected in the main stream of condensate in parallel with the second-stage heater. Used as a closed heater, the vent condenser is many times larger than those usually installed with deaerating heaters. The deaerating equipment is designed on the principle that it is not the main stream of condensate that causes most corrosion, but condensate drips and makeup.

The deaerator shell, also, is oversized to accommodate a large volume of hot condensate, pumped from the first or low-pressure heater, together with the hot condensate from the other stage heaters, along with the required makeup water.

In this heat-balance system, the deaerator is a collecting point where all drips are deaerated and then pumped directly into the main stream of condensate for use in the boilers.

Pressure in the deaerator is established at five pounds above atmosphere and so maintained by a 3-way valve in the main stream of condensate. By this valve water on its way to the boiler-feed pump suction can be passed either through the second-stage heater or through the deaerator vent condenser. More water is passed through the vent condenser when pressure rises above five pounds, less water to vent

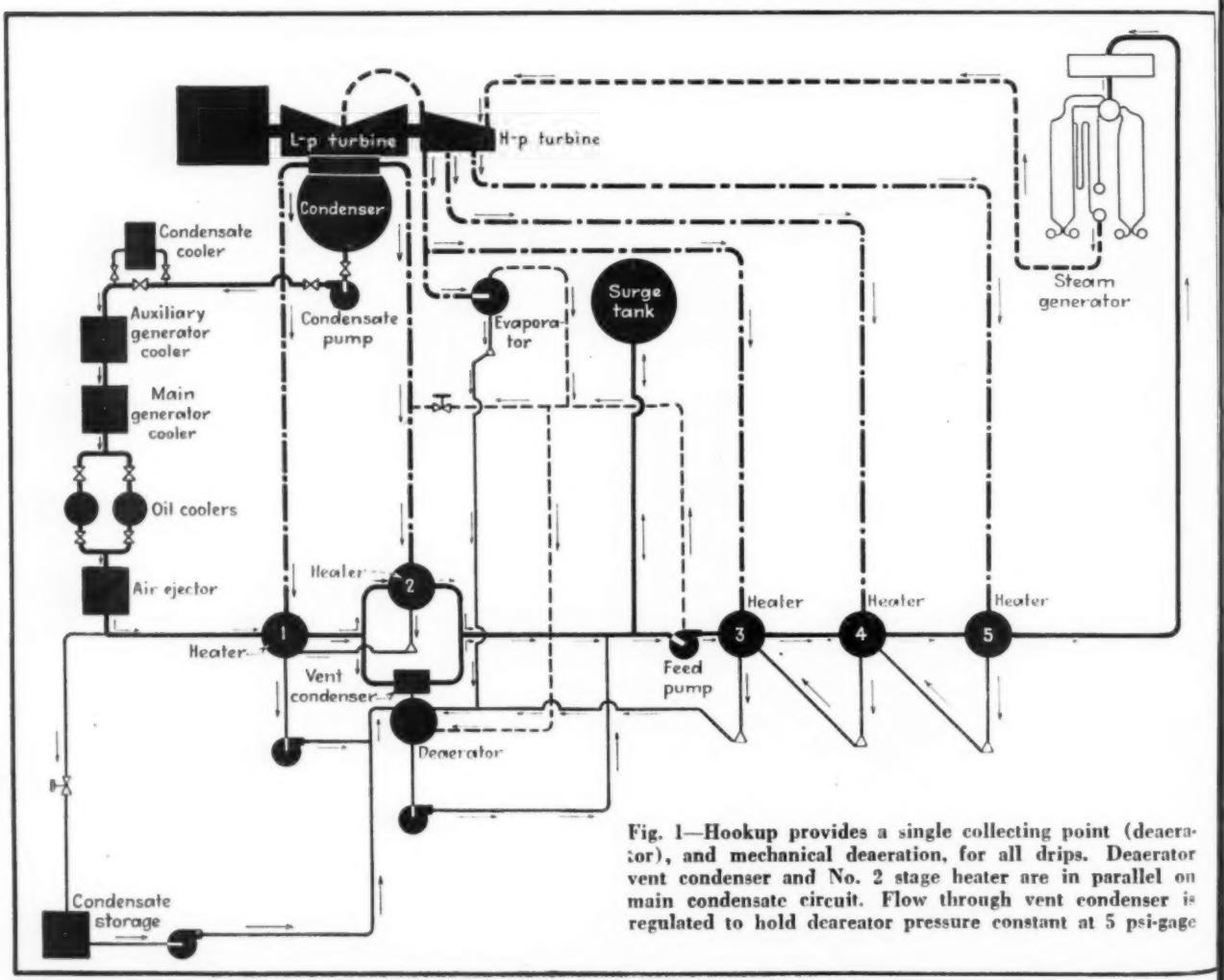


Fig. 1—Hookup provides a single collecting point (deaerator), and mechanical deaeration, for all drips. Deaerator vent condenser and No. 2 stage heater are in parallel on main condensate circuit. Flow through vent condenser is regulated to hold deareator pressure constant at 5 psi-gage

condenser (and more to No. 2 heater) when the pressure falls below five pounds.

By operating at constant pressure of five pounds, consistent deaeration is assured despite a variable turbine load. This arrangement prevents below-atmospheric operation at light loads and also eliminates a blowdown pump and an evaporator feed pump. Feed to evaporator, as well as blowdown from evaporator, is much easier to regulate.

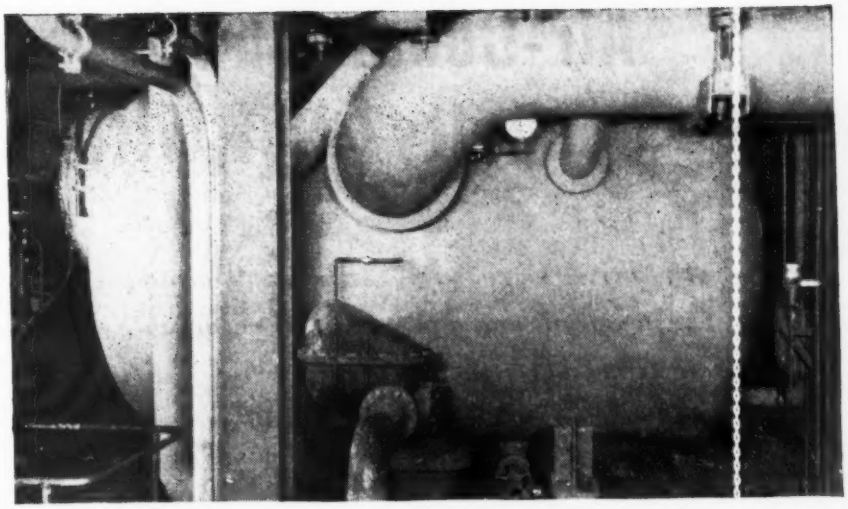
In start-up this system deaerates the main stream. Later, under part-to-full operating load, only heater drains, drips and makeup are deaerated. During the start-up period, complete deaeration of all boiler feed is necessary until the condenser is *de-aired*. To accomplish this, a deaerator only one third the size necessary to deaerate full-load boiler feed is used.

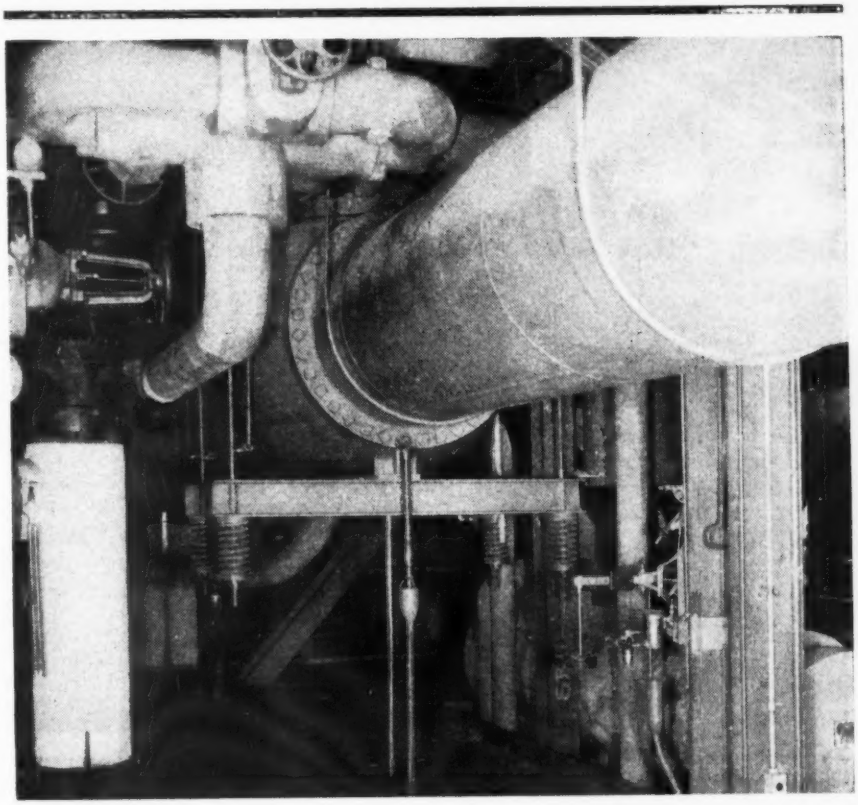
Advantages of System

After the start-up period the deaerator and its vent condenser are used: (1) to condense vapor from the evaporator and steam from auxiliary turbine (2) to flash the heat from the high-pressure heater drains (3) to deaerate all drips and auxiliary condensate before they enter the main stream of condensate.

This hookup retains a maximum amount of heat in the cycle, provides a collecting point for all drips and assures continuous mechanical deaeration of all drips.

Complete deaeration of all condensate was seriously considered in the design of this station. However, it was found that main condensers incorporating deaerating-type hotwells were available and would reduce the necessary investment in deaerating equipment about 50%. Under the circumstances, it seemed sensible to deaerate the drips only. Floor space and pipe arrangements will allow adding another deaerator if desirable, but this has not been needed so far.





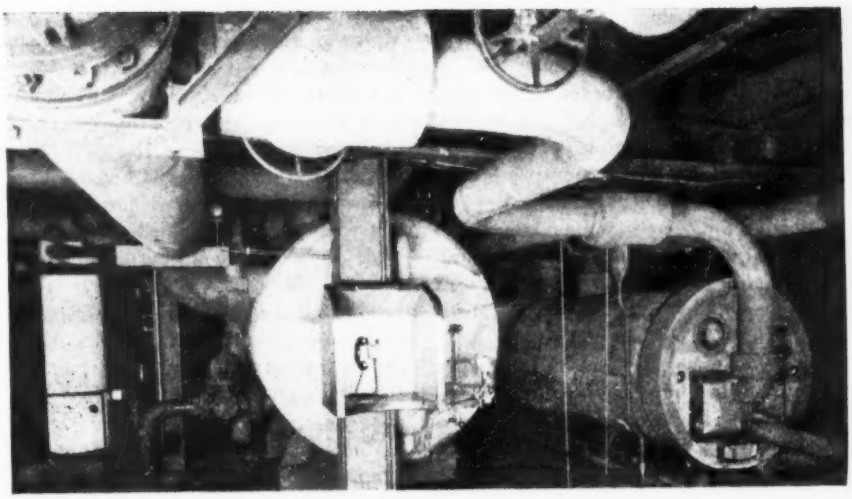


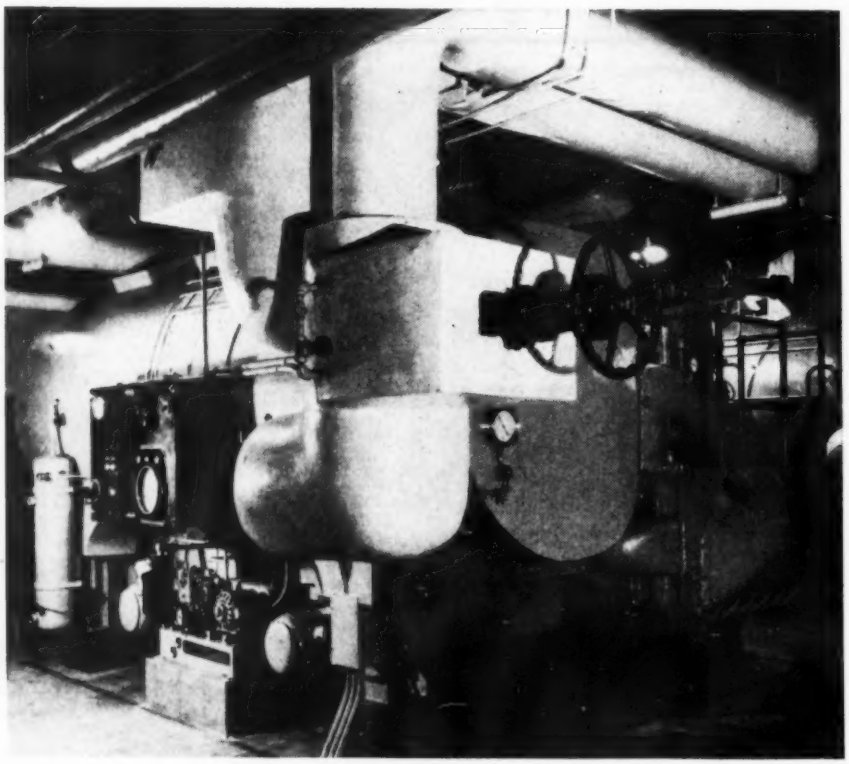
Fig. 2, *top*—This Elliott deaerator has oversized shell to accommodate a large volume of hot condensate

Fig. 3, *center*—A main condensate flow proportioner (upper center) passes more water thrugh the vent condenser (lower right) when pressure rises above five pounds. When pressure falls below five pounds, less water is admitted

Fig. 4, *bottom*—Deaerator is in center of picture, with No. 2 low-pressure heater at left and evaporator at right

Air-Conditioning Units a War Casualty? Not With This Plan!

H R Jaeggli, Carrier Corp, says "Arm your maintenance men with clear instructions and a check list of vulnerable mechanical and electrical parts to insure protection against equipment breakdown or loss of critical hard-to-get refrigerant"



Air-conditioning and refrigerating equipment in non-essential industries cannot be replaced, so keep yours going with judicious doses of inspection and repair

▶ YOU CAN PREVENT LOSSES and give equipment longer life by setting up a maintenance schedule to time the inspection of: (1) refrigerant circuit, consisting of compressors, condensers, evaporators and controls (2) air-handling circuit, made up mainly of fans, motors, dampers and filters.

Refrigerants most commonly used in air-conditioning systems—Freon and methyl chloride—belong in the halogen group. With both oil is miscible in all proportions, and the amount of oil in circulation becomes important because crankcase dilution affects reciprocating-compressor life. Circulating oil carries along large amounts of refrigerant, which are almost as destructive as a too widely opened expansion valve that allows liquid refrigerant to enter the crankcase.

Indications of excessive oil circulation are: (1) foamy crankcase oil as observed through the bullseye (2) cool or sweating crankcase (3) heavy oil concentrations in the refrigerant liquid when tested at the liquid-level test cock. Make these checks only after the system operates for 20 to 30 min to reach normal running conditions. Crankcase should operate at 100 to 130 F. Adjust the expansion valve so that vapor from the evaporator has from 6 to 13 F superheat.

Check refrigerant piping, as well as compressor and coils, periodically for leaks. With Freon-12 too much emphasis cannot be placed on this, because refrigerant can be replaced only in essential war installations. Use a good Halide torch for this purpose. Test pressurestat settings and, if compressor uses force-feed lubrication, check the oil pressures. Do not allow gages to register continually; close them off after tests to prevent damage and possible loss of refrigerant.

Use Scale-Free Water

Water-cooled condensers must have scale-free water to operate satisfactorily over long periods. Some sources are: (1) surface water in rural districts—experience indicates it is usually the best (2) municipal water taken from good sources, usually chemically treated to make it satisfactory (3) river water in industrial areas, often contaminated by corrosive trade waste (4) well water—particularly from deep wells—usually harder and often the cause of trouble from scale and dissolved gas.

Analyzing a sample of the water shows what must be done to ward off trouble. Check it for color, odor, suspended matter, pH, silicon, iron, alumina, calcium, magnesium, carbonates, sulphates, chlorides, total hardness, dissolved oxygen and carbon dioxide. Water for condensing purposes should have a pH from 7.5 to 8.5. The U. S. Geological Survey classifies municipal water supplies into four relative hardness groups (expressed in terms of calcium carbonate):

1. Less than 60 ppm: soft
2. 60 to 120 ppm: fair
3. 120 to 180 ppm: hard
4. Over 180 ppm: very hard

Provide softening treatment as recommended by water-treatment specialists for classes 3 and 4 when used on evaporative condensers and for class 4 in shell-and-tube units.

Here are good methods for removing scale. On watercooled shell-and-tube-condensers, the inhibited-acid method is most satisfactory and comparatively easy. Removing scale from evaporative condensers, however, presents a difficult problem. These methods give varying degrees of success:

1. Operate condenser without spray water to heat and crack the scale so that

when water is again turned on, the scale washes away.

2. Spray the tubes with a ¼-in. stream of water under a pressure of 75 psi.

3. Submerge the condenser coil in inhibited acid (hydrochloric acid with phosgene GN inhibitor). This is a lengthy job with the disadvantage of making it necessary to pump the system down and open the refrigerant circuit to atmosphere. Do not add inhibited acid to the spray water because it removes the galvanizing as well as scale, and rusting of the entire unit results.

4. Most satisfactory way to keep tube surfaces clean is to remove the scale-forming substances from the water by softening treatment. Therefore, it is not a cleaning method but a preventive.

Protect precooling condenser and water coils against freezing by blowing out with air or circulating antifreeze solution through them. Extensive tests and experiments upon a wide variety of water coils used with air-conditioning equipment show that, even though level, a tube coil does not completely drain itself. Residual water must be forcibly removed. Blowing compressed air through a small connection is not satisfactory because of the volume required.

A blower that supplies 150 cfm at 4-in. water pressure through a 2-in. connection purges a bank of three coils in parallel. Multiples of that quantity do the job satisfactorily on multiple-coil banks. Blowers can be portable or installed permanently.

Inspect Air Equipment

Protection of the air-handling equipment is much simpler. Bearings must be greased, motors oiled and belts tightened. Inspect and clean filters and spray nozzles because any variation in the humidity or quantity of air treated seriously affects the results.

The importance of regular inspection and servicing cannot be stressed too highly. To simplify the routine, make check lists as shown, and label them for each type of equipment. List names of items to be checked on the left. Three columns headed *monthly*, *shut down*, and *start up* provide space for checking or dating the service. Solid black bars indicate when to inspect. For instance, the black bar appearing in all three columns for item 1, *Oil motor bearings*, means that they should be oiled monthly, at shut down and at start up. Item 14 indicates that the condenser should be drained at shut down. Scheduled inspection gives the equipment a longer life of dependable, economical service.

MAINTENANCE CHECK LIST

Summer Cooling Installation

DATE INSPECTED:.....

Equipment	*Monthly*	*Shut down*	*Start up*
Compressor			
1. Oil motor bearings	■	■	■
2. Check drive belts	■		
3. Check oil level	■		■
4. Check head pressure	■		■
5. Check suction pressure	■		■
6. Check pressurestat setting			■
7. Check rotation			■
8. Slack off belts		■	
9. Align and adjust belts			■
10. Check head bolts	■	■	■
11. Check cylinder by-pass pressure-stat setting			■
12. Check oil pressure	■		■
Water cooled condensers			
13. Check water regulating valve for best economy	■ ■		■ ■
14. Drain condenser		■	
15. Reconnect condenser piping			■
Evaporative condensers			
16. Oil motor bearings	■	■	■
17. Grease fan bearings	■	■	■
18. Grease pump bearings	■	■	■
19. Check drive belts	■		
20. Slack off belts		■	
21. Check rotation of fans			■
22. Check condition of coils (scale)	■	■	
23. Check spray nozzles. Clean if necessary	■ ■	■ ■	■ ■
24. Clean drip pan and drain	■	■	
25. Clean water strainer	■	■	
26. Clean pump strainer	■	■	
27. Clean air intake screen	■	■	
28. Check float control	■	■	■
29. Drain water piping and drip pan		■	
30. Reconnect water piping			■
31. Align and adjust belts			■
32. Check fans for alignment			■
Other equipment inspected			

INSPECTED BY:.....

Equipment	*Monthly*	*Shut down*	*Start up*
Cooling units			
33. Oil motor bearings	■	■	■
34. Grease fan bearings	■	■	■
35. Grease pump bearings	■	■	■
36. Check drive belts	■		
37. Check rotation of fans			■
38. Check fans for alignment			■
39. Slack off belts		■	
40. Align and adjust belts			■
41. Check filters	■	■	■
42. Clean expansion valve		■	
43. Clean drip pan and drain		■	
44. Clean intake screen	■	■	■
45. Check expansion valve adjustments	■		■
46. Check pump strainer	■	■	
47. Check spray nozzles. Clean if necessary	■ ■	■ ■	
48. Drain water coils (water cooling)		■	
49. Reconnect line to water coils			■
Controls			
50. Clean commutators D.C. motors	■	■	
51. Check thermostat setting and clean points	■ ■		■ ■
52. Check contact points in starters	■	■	
53. Check damper motor on unit	■		■
54. Observe operation of system	■		■
55. Check controls on water cooler	■		■
56. Air controls — drain water	■	■	
57. Clean air compressor intake	■	■	
58. Check air compressor oil	■	■	■
59. Oil air compressor motor	■	■	■
General			
60. Pump down system		■	
61. Test for refrigerant	■		■
62. Test for leaks	■	■	■
63. Check damper settings	■		■
64. Check well water pump	■		
(a) drain		■	
(b) connect piping and tighten packing			■ ■
65. Instruct operator how to operate equipment and inform him of any changes or adjustments made.	■ ■ ■ ■		■ ■ ■ ■

REMARKS and RECOMMENDATIONS:

NOTE: ■ Indicates when operation is necessary

Typical Specifications for Gas-Turbine Power Units

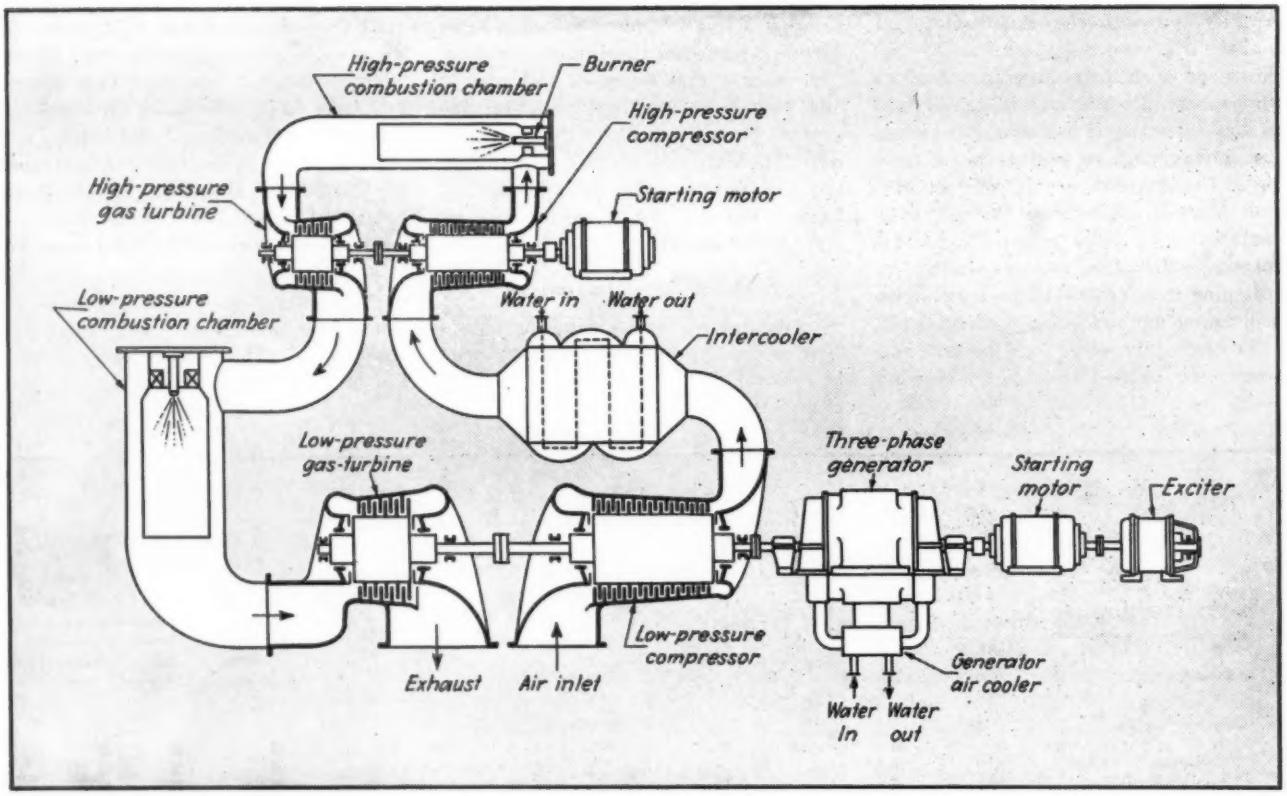


Fig. 1—Single-shaft arrangement of basic gas-turbine cycle with heat exchanger can be built in sizes of 1000 to 5000 kw, with or without reduction gear, depending on size within the range. Efficiency depends on size of heat exchanger

► So MANY VARIATIONS of gas-turbine power units have been proposed for possible future development "when materials to stand high temperatures become available" that it seems appropriate to detail the characteristics of such machines as can now be built with known and tried metals and designs. After eight years' experience with Houdry sets, six years' operation of the only commercial gas-turbine power unit and performance of Velox charging sets for a much longer period, Brown Boveri are prepared to construct stationary gas-turbine-generator sets from 1000 to 12,000 kw capacity, with firm guarantees on output and thermal performance.

So that details can be quite specific, schematic drawings and efficiency data have been assembled for three typical machines of different arrangements and capacities. While each can be built in a range of sizes, performance is here given for units developing a net output of 3500, 5000 and 10,000 kw.

As is well known, the efficiency of gas turbines increases greatly with even relatively moderate increase in gas temperature at the throttle. However, to avoid any question of overoptimism as to performance of metals above temperature limits within existing experience, the machines here described have been designed for 1112-F (600 C) maximum temperature at the gas-turbine inlet.

Simple Single-Shaft Unit

The simplest single-shaft gas-turbine unit has, for this temperature, a base efficiency of about 18% (19,000 Btu per kwhr) comparable with that of the Neuchatel standby unit, now in operation since the fall of 1939. Means for improving this efficiency are well known and have been described repeatedly: (1) heat exchange between exhaust gas and combustion air (2) intercooling between compressor stages and (3) reheating between stages of the gas turbine in additional combustion chambers in which added fuel is fired.

Two of the typical machines described here represent an arbitrary selection of heat-exchanger surfaces, which can be varied at will to suit individual needs and thermal efficiency requirements.

Fig. 1 illustrates a single-shaft arrangement with heat exchanger suitable for net outputs between 1000 and 5000 kw. A reduction gear between main shaft and generator may not be necessary in every case as best speed for the compressor decreases with increased capacity of the unit. A 3500-kw generator, for example, could be direct-coupled at 3600 rpm, while a 5000-kw machine of this type would have its best speed at about 3000 rpm, suitable for direct coupling at 50 cycles but geared to 1800 rpm for 60-cycle operation.

Improved design of heat exchangers makes possible economical use of much larger surfaces than were considered practical a few years ago. With a heat exchanger of 7½ sq ft per kw, the base efficiency of the unit is increased from 18% to 23% (15,000 Btu per kwhr),

After 14 years of building gas-turbine axial-compressor sets, Brown Boveri have formulated finished designs for stationary power-generating plants from 1000 to 12,000-kw capacity

By PAUL R SIDLER,
resident engineer
Brown, Boveri & Co, Ltd,
Switzerland

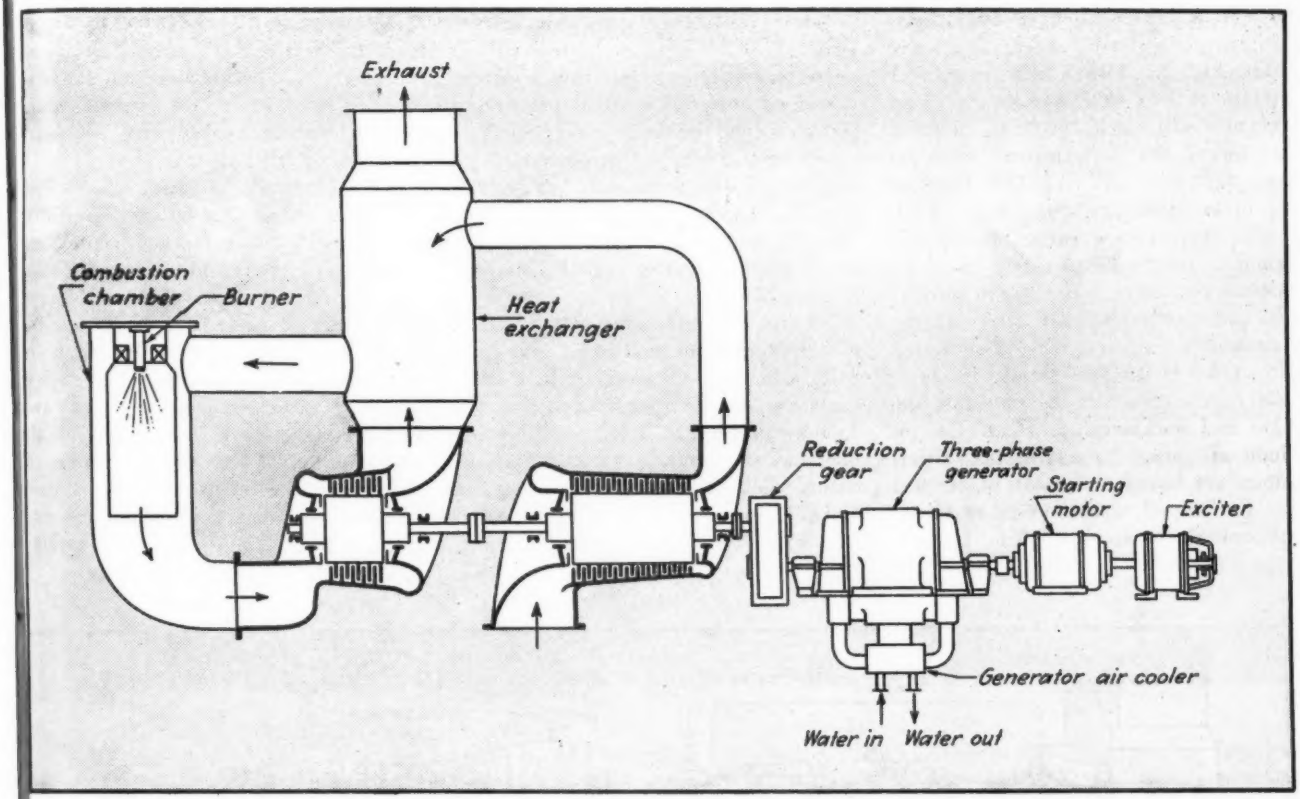


Fig. 2—Two-shaft unit with two-stage air compression and gas expansion, with intercooling of air and reheating of gas for sizes between 5000 and 12,000 kw. Low-pressure machine runs at constant speed while high-pressure set varies to suit compressor

TECHNICAL DATA

Gas-turbine set, net kw		3500	5000	10,000
Heat content of bunker oil, Btu per lb		18,000	18,000	18,000
Heat content of natural gas, Btu per cu ft		1000	1000	1000
Temperature of air at compressor suction, F		68	68	68
Temperature of cooling water (intake), F		68	68	68
Air weight taken in by l-p compressor lb per hr		440,000	605,000	660,000
Air pressure at last compressor exit, psig		60	60	157
Gas pressure before l-p turbine, psig		59	59	35
Gas pressure before h-p turbine, psig		.....	.....	156
Gas temperature before l-p turbine, F		1112	1112	1022
Gas temperature before h-p turbine, F		.....	.....	1112
Exhaust-gas temperature at heat-exchanger exit (stack)	23% eff, F	455	464	.....
	26% eff, F	383	392	.....
	27.7% eff, F	.....	.....	338
Total cooling water quantity gpm		103	150	2230
Starting time from cold to full load, minutes		8–10	8–10	12–15
Intermittent input for starting during about 6 minutes, kw		140	200	450

and with 13 sq ft per kw, to 26% (13,200 Btu per kwhr).

For larger machines, say 5000 to 12,000 kw, it is desirable to provide for 2 stage air compression with intercooling and reheating, as in Fig. 2. A power unit of this type for 10,000-kw net output at 50 cycles is now under construction in the Brown Boveri shops. It will be fired by natural gas of 1000 Btu per cu ft.

The low-pressure set runs at 3000 rpm, direct coupled to the 50-cycle generator while the high-pressure set has a full-load speed of 5000 rpm, lower at partial loads. Each set has a starting motor to bring the units up to speed simultaneously. Total starting time from cold to full load is less than 15 min.

This unit will be used in standby service where low first cost and simplicity are deciding factors. The generator is coupled to the low-pressure shaft to avoid a reduction gear, partial-load efficiency would be higher if the generator were geared to the high-speed

high-pressure element. Heat exchanger is omitted to reduce first cost.

At full load, this unit has a thermal efficiency of 21% (16,400 Btu per kwhr) decreasing to about 14% at half load (25,000 Btu per kwhr).

For base-load operation, units from 5,000 to 12,000 kw employ two intercoolers, a heat exchanger and direct-coupled generator on the high-pressure shaft, Fig. 3. With a heat exchanger surface of 3.75 sq ft per kw, full-load efficiency will reach 27.7% (12,400 Btu per kwhr) the performance curve remaining above 24% (14,000 Btu per kwhr) for all outputs down to half load.

The performance values quoted are firm guarantees, subject only to an allowance of plus or minus 3% to account for inaccuracies of test (5% for the base-load machine of Fig. 3). Rated output for continuous service is specifically guaranteed, as are materials, designs and workmanship. Heat rates include all power to auxiliaries. Guarantees are based on use of 18,000 Btu per lb fuel oil, usually bunker C, an atmospheric pressure of 30 in. Hg and temperature of air inlet 68 F.

No-load fuel consumption is about 40% of that of full load so that operation for long periods at or near zero load is not economical. It is recommended that gas turbines be started and stopped as needed.

Cooling Requirements

While gas-turbine units can be constructed to be completely free of the need for cooling water, the machines described here follow usual practice of water cooling of generator air cooler, oil cooler and, of course, intercoolers where employed. For single-shaft units, like Fig. 1, a maximum of 150 gpm of 68-F water is needed; with intercoolers, total water consumption of a 10,000-kw unit reaches 2230 gpm.

To give a specific idea of the details of equipment and auxiliaries that comprise a gas-turbine power unit, a brief summary of the specification for the 3500-kw unit of Fig. 1 follows. The turbine has six blades rows and shaft of chrome-nickel alloy steel, casing of molybdenum steel, anti-friction bearings with pressure-oil lubrication, overspeed trip with gas bypass. The axial-flow compressor has 24 blade rows and shaft of nickel steel, casing of special cast iron, anti-friction bearings with pressure lubrication. Combustion chamber is arranged with cylindrical cooling space, nozzle, ignition, lagging, etc.

A 26,500-sq-ft heat exchanger for this unit occupies a space 16x14x10 ft, approximately, while a 46,000-sq-ft surface needs 17x15x11 ft. All interconnecting piping between suction flange of the air compressor and exhaust flange of the heat exchanger with necessary insulation is included.

The generator, if directly coupled, runs at 3600 rpm for 60 cycles, 2400 v, 0.7 pf, with 23-kw 110-v overhung exciter, field rheostat and automatic voltage regulator. Three-phase 1150-rpm 550-v starting motor is rated 140 kw for 10 min; starting resistor and switchbox are furnished. Generator air cooler, complete with signaling device and thermostats, passes 10,200 cfm of air and requires 93 gpm of 68-F water. A switchboard, with two panels, control devices, switchboxes for auxiliary motors, standard indicating instruments

(*Continued on page* 212)

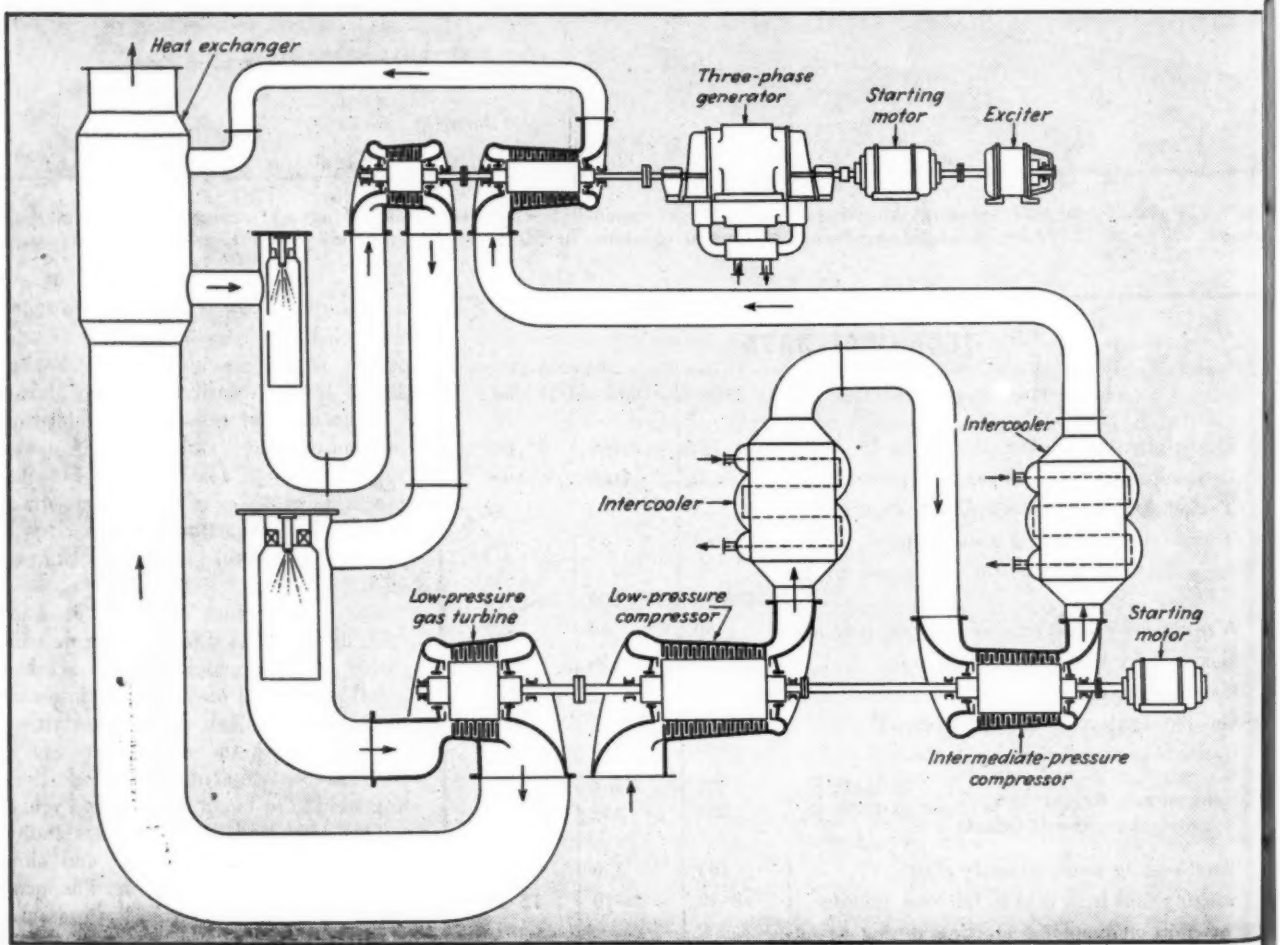


Fig. 3—For base-load power units in the 5000 to 12,000-kw range, efficiency is improved by two stages of intercooling, gas reh and a relatively large heat exchanger. Generator is coupled to the high-pressure element as indicated

Australian Power Site's Got What It Takes to Make an Engineer Happy

Power plant is adjacent to an open-pit mine on the south bank of the Latrobe River. Water intake in the foreground

Yallourn has an open-cut mine in the back yard, condensing water at the front door and a power and fuel market within easy reach. John S T Shotwell describes the power setup

Fig. 1—Electrically operated shovels remove overburden and excavate coal. Frame mounts on four sets of four double-flanged wheel bogies for rail traction

► LACKING SUITABLE hydroelectric power sites, continental Australia depends for electric power almost entirely on steam generation. The highly industrial state, Victoria, in the southeast, draws fuel for power from a large brown-coal field suitable for stripping.

Here, one hundred miles east of Melbourne, the State Electricity Commission has developed Yallourn, a power and mining site, shown in the photo above. It is on the Latrobe River, one mile from an existing open-cut mine operated by the Mines Dept.

Local coal deposit is estimated to be not over 20 million years old. Portions of the mass retain their woody structure, even showing resin and pine cones in their natural colors. Aside from this, the coal has a homogeneous structure and deep brown color. Seams vary in width but in general are remarkably thick; in one instance a 1000-ft bore passed through three separate veins, 366, 227 and 156 ft thick.

At the power-plant site, overburden

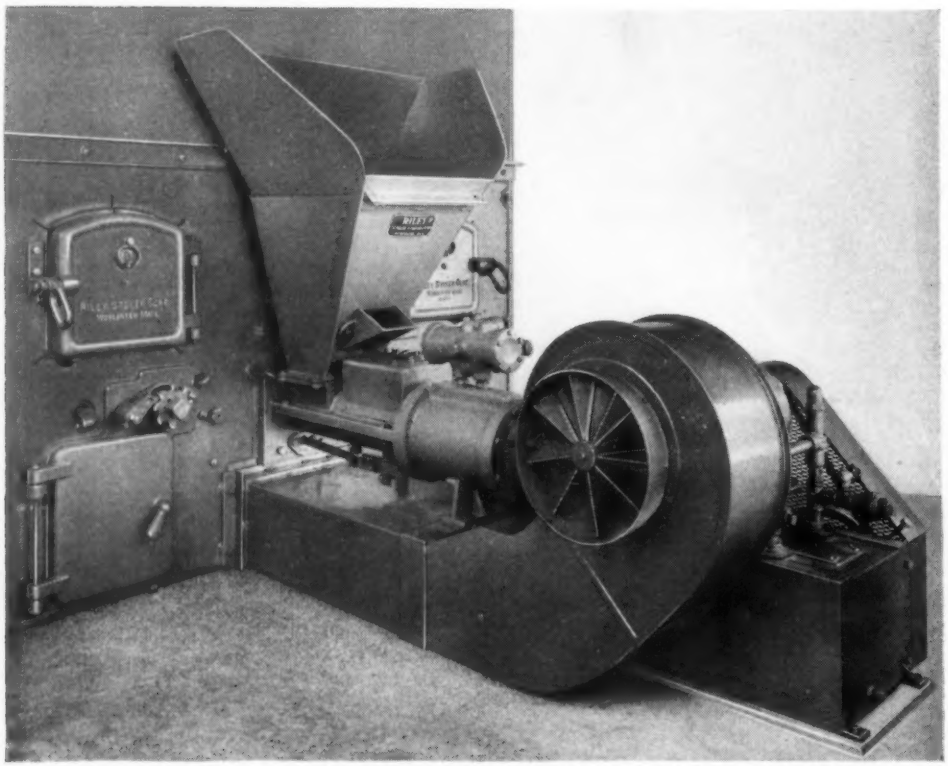
(*Continued on page* 98)

Riley-Jones Stokers Save

Riley-Jones Automatic Stokers pay for themselves within a few years—in many cases in less than two years—through coal and labor savings. Their installation reduces coal consumption over hand firing from 20% to as much as 40 to 50%. Consequently, if your coal allotment this winter should be reduced to 75 or 80%, you could easily make up this cut by using Riley-Jones Stokers, thereby preventing curtailment of production.

Riley Stoker Corporation can make prompt shipment to enable you to install these stokers before your winter load comes on. Just write us and a Riley engineer will survey your plant and advise you what savings you can expect, without any obligation whatsoever to you.

Riley-Jones Stokers in addition to saving coal and labor
- Burn cheaper, lower grade coals
- Prevent smoke
- Increase steam capacity of boiler
- Give uniform constant pressure
- Reduce labor turnover



Riley-Jones Hydraulically Driven Side Dump Stoker

These Well Known Companies

Bell Aircraft Company
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Royal Typewriter Co.
Yale University
C.C.C. & St. L. R.R. (Big Four)
American Creosoting Co.
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Coal so Vital for Victory

These Riley-Jones Stoker Users tell you of their Coal Saving experiences with this stoker

"Fuel cost of $5000.00 per year has been cut 25% since the stoker has been in use."
St. Louis Country Club, Mo.

"Our coal consumption was reduced as follows:

Hand Fired	1275.5 tons
Jones Stoker Fired	1017 tons
Saving	258.5 tons

Jos. H. Hill Co., Richmond, Ind.

"Regardless of how efficiently any hand fired plant may be operating, you can be sure of from 10 to 25% saving in fuel and labor with this type stoker."
Large Railway Equipment Manufacturer

"With stokers of another manufacture, our average consumption of coal per day was 10 net tons. With the Riley-Jones' we average less than 7 net tons per day."
North American Brewing Co., Brooklyn, N. Y.

"We have effected a general overall boiler room operation saving of 30%."
Martin Dennis Co., Newark, N. J.

"Our saving in using the Riley-Jones Stoker over hand firing amounts to from three to four tons a day."
Pet Milk Co., Delta, Ohio

"Using hand firing, we evaporated only about 6½ pounds of water per pound of coal. With the Jones Stoker, we are getting 9.3 pounds of evaporation per pound of coal."
S. B. Foote Tanning Co., Red Wing, Minn.

Thousands of Riley-Jones Stoker installations have paid for themselves through savings and then paid dividends. They can do the same for you.

Use Riley-Jones Stokers

Ford Motor Company
American Steel & Wire Co.
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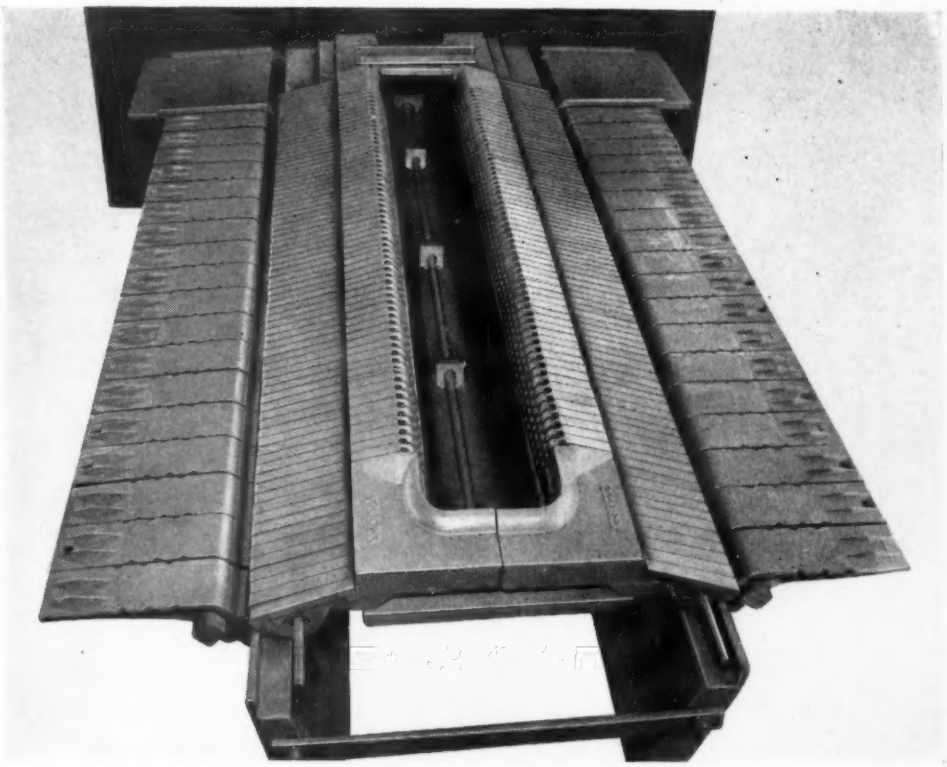

Inside Furnace Parts—Riley-Jones Side Dump Stoker

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
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consisting of sand, sandy clay and gravel varies in thickness from 20 to 40 ft, Fig. 1, whereas coal ranges from 120 to 180 ft. In one square mile set apart for initial working, 150,000,000 tons have been proved.

Because the area of operation is below river flood level and acts as a natural outlet for surface water from hills to the southwest, it has been necessary to build levee banks 3 ft above the highest flood level ever reported.

Overburden has been stripped for about 200 ft from the open cut, Fig. 2, whose width is 600 ft from north to south. To reduce the coal's moisture content, an extensive drainage system was cut near the bottom of the bed, 160 ft below the surface. Shafts were sunk and 15,000 ft of 4x6-ft laterals driven, the latter being spaced 450 ft apart. A 3-throw 4000-gal-per-hr plunger pump removes water from the lowest point. An extensive surface system, with two 15,000-gpm and three 750-gpm pumps, and several smaller units, lifts surface water out of the cut.

Coal Removal

Electrically operated (1000-v, dc) bucket dredges remove overburden and coal from the open pit, Fig. 2. Each bucket holds 15 cu ft. Overburden goes to the dumps in 20-cu-yd cars hauled by electric locomotives. Cars are dumped either singly or collectively by compressed air from the locomotive.

Electrically operated shovels, working along benches parallel to the pit length, excavate coal for the dredges, the first cut being 27 ft deep along the northern site. Each shovel has a 10-cu-yd dipper, 58-ft handle and 90-ft boom. Working weight of the machine is 380 tons, of which 60 is ballast. The frame is mounted on 4-wheel bogies with double-flanged wheels. Traveling power, capable of driving the machine up 10% grades, is transmitted by gearing from the hoisting motors. Revolving frame is heavy steel, mounted on a turntable track, Fig. 1. Bogies are swiveling.

The shovel is operated by Ward-Leonard control, using 6600-v 3-phase ac obtained from two connecting stations by a flexible trailing cable. After excavation, coal goes to the hopper of a traveling loading machine, which breaks it into convenient sizes and loads it into bins or into trucks of a cable-haulage system.

Receiving depot for coal is a screen house. Here it is classified into three grades: coarse, nut and fine. Coarse and fine coal go to the briquetting factory, and nut direct to the power plant. As the demand for medium and fine coal at the power plant and briquetting factory, respectively, far exceeds that for coarse, a recrushing plant converts remainder of the coarse to medium and fine. Crusher mounts over the screens and is fed from the coarse screen by a cross-conveyor. Three 30-in. conveyor belts running 400 fpm discharge the coal to an elevator conveyor belt, which takes it up an incline to storage bunkers about 120 ft from the screen house.

Storage Facilities

Storage bunkers consist of sixteen 2500-ton reinforced-concrete hopper-bottomed bins. Traveling tippers are arranged so that each conveyor can discharge into eight different bins standing in four rows. Victorian State Railways

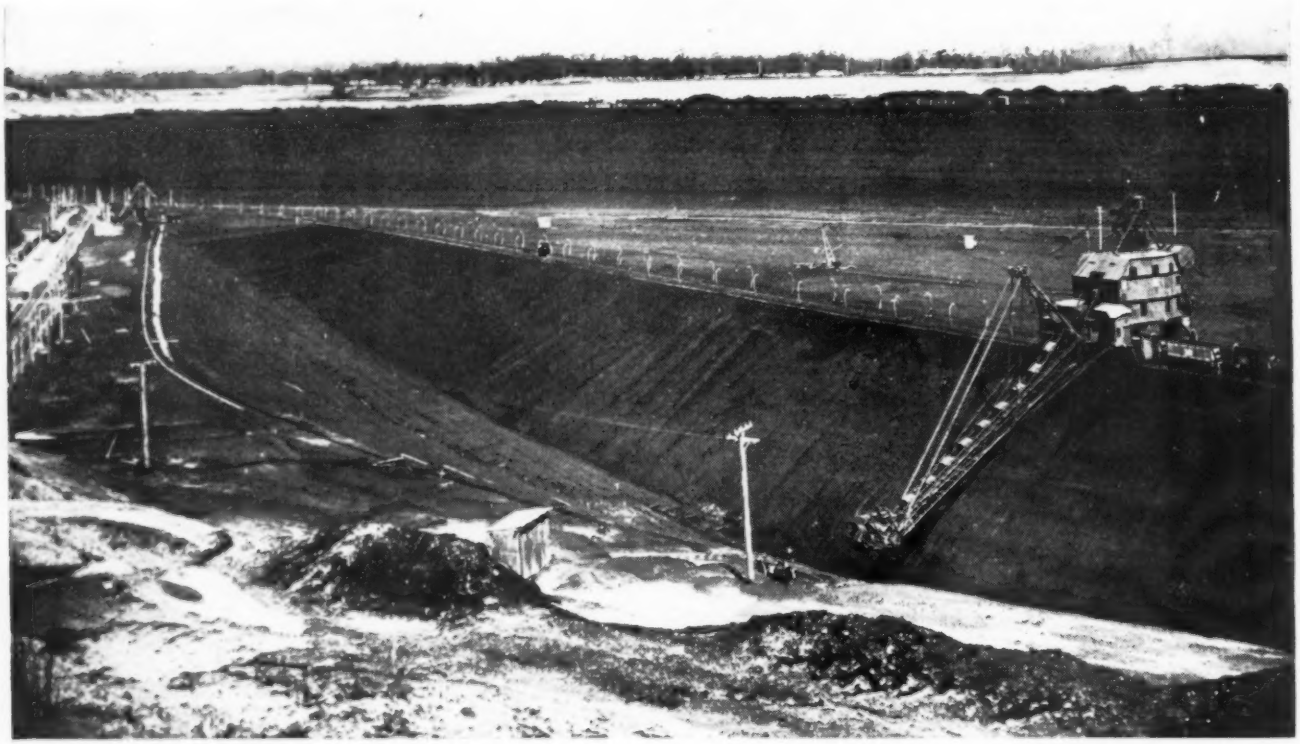


Fig. 2—After excavation with power shovel, bucket dredge elevates the coal and loads it into railway dump cars

Fig. 3—Electric locomotives transport coal and overburden in 20-cu-yd cars

Fig. 4—Electrically operated dredge carries 15-cu-ft buckets on endless chain

Coal is also transported from the cut in 20-ton cars drawn by electric locomotives, Fig. 3, and dumped into storage bins, whence it passes through crushers onto elevator belts that convey it to the power-plant bunkers.

Remainder of the Yallourn development consists of a 200,000-hp steam-electric-generating station and a 1200-ton-per-day briquetting factory. Power is generated at 11,000 v, 3-phase, 50 cycles, and is stepped up to 132,000 v for transmission. Switching and transformer stations are outdoors.

Power plant operates in conjunction with the briquetting factory; the main steam drums and three 28x3-ft. 3-in. mud drums, interconnected by 924 straight solid-drawn steel tubes—3½-in. OD, 17 ft long.

In addition to the steam and mud drums there are two receivers, each 8 ft long and 3 ft in diameter, which discharge through 8-in. mains to the superheaters. Mud-drum centers are 14 ft, 6 in. above the firing floor and steam-drum centers are 18 ft, 6 in. higher.

Furnace stokers are traveling-grate units, three to a boiler; each 2 ft, 11 in. wide and 15 ft, 6 in. long, with an effective area of 122 sq ft. A 10-hp motor in the boilerhouse basement drives each

Fig. 5—Initial installation had a capacity of 62,500 kw in five 12,500-kw turbines. Photo shows one of newer units in rear

sidings run to three of the bin rows and under the screen house, so that each grade of coal can be discharged into railway cars. Under the fourth row, trucks connected to a rope haulage system transport coal directly to the power plant or briquetting factory. At the discharge end they automatically dump the coal into bins feeding coal-handling equipment which, in turn, removes it either to storage or to the power plant bunkers.

Coal comes into the bunker house above the boilers on two single-track monorail traveling-bucket conveyors equipped with 3½-ton grabs. Upon entering the bunker house the cars pass over automatic weighing machines, which integrate and record the quantity.

building being a steel-frame and brick structure. The plant design permitted erection of only those initial buildings needed for immediate power demands and, later on, of additions in predetermined stages to meet increased loads. First section consisted of a 28x70-ft turbine room with a 140x22-ft feed annex and a 225x105-ft boilerhouse.

Steam Capacity

Initial steam-generating equipment comprised 12 boilers each guaranteed to evaporate 70,000 lb per hr at 260 psi from 160-F feedwater. Steam is superheated to a final temperature between 650 and 700 F. Each boiler has 14,425 sq ft of heating surface with a 2320-sq-ft superheater, three 32x3-ft. 9-in.

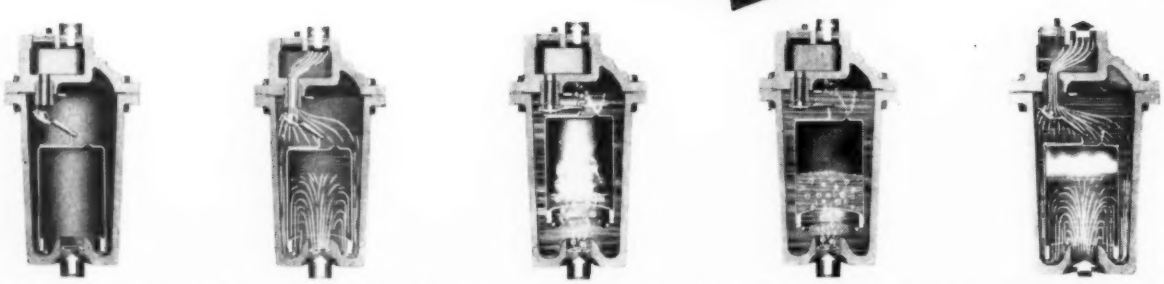
stoker through a line-shaft and worm gears.

A 40-in. 52,000-cfm, double-inlet fan, in the basement, supplies air for each boiler. Fan connects direct to a 50-hp 570-rpm 3-phase motor equipped with pushbutton control. Air feeds through ducts to boxes beside the stokers, and fuel-bed supply is regulated by dampers. In the combustion space a return arch over each stoker forces gas back over the burning fuel to insure thorough mixing and uses both radiant and direct-contact heat for final drying of the coal. In addition, the arch insures complete combustion of the fine particles blown off by disintegration of drying coal. Initial drying takes place be-

(*Continued on page* 102)

. . . if your

Left — An Armstrong Inverted Bucket Trap with a glass body enabling engineers to see it operate!



1 *Steam off. Bucket down. Valve open. Inlet bottom. Outlet top. When steam*

2 *is turned on, water fills body. Excess water escapes through orifice until*

3 *steam reaches trap and fills bucket which floats and closes orifice. When*

4 *steam condenses, water enters. Bucket loses buoyancy, pulls on lever.*

5 *When weight of bucket times leverage equals pressure on valve, trap opens.*

traps were made of

GLASS

. . . you'd see the difference

If you could look into steam traps and watch them operate you'd quickly see why so many plants are 100% Armstrong trapped. Armstrong built a trap with a glass body for exhibit purposes and many engineers have seen it work. They have seen that when steam enters the trap, the bucket floats and closes the valve absolutely steam tight. They have seen when condensate enters the trap the bucket sinks and opens the discharge valve. They have seen how particles of dirt and scale are swirled right through the trap without causing it to clog or stick or become inoperative. They have seen air bubble up through the bucket vent to collect at the top of the trap where it will be discharged when the valve opens.

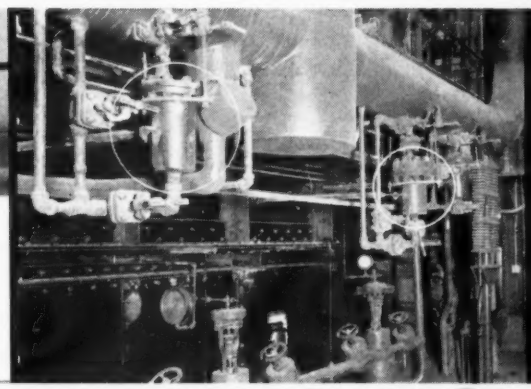
They have seen the simplicity and quality of a trap that saves steam, increases machine temperatures and stays on the job. If you want to look into steam traps, write today for the Armstrong Steam Trap Book—36 pages of data, prices, capacity charts, tables and information on trouble shooting, trap installation practice, etc.

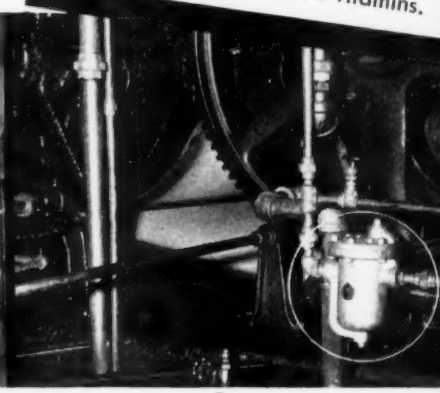
ARMSTRONG MACHINE WORKS
812 Maple Street • Three Rivers, Michigan

CUTS FUEL COSTS 35%. (File 4-43) Peerless Laundry Services, Ltd., Los Angeles, California, reduced fuel consumption approximately 35%, reduced heating up time by 30 minutes and reduced maintenance 8% by simply installing Armstrong Unit Trapping. (Normal boiler load is 50,000 lbs. per hour.)

HEATING UP TIME R DUCED 20%. File 1-43) Whe the boys in the production lin want to get a machine going they don't like to stand around all day waiting for it to heat up. At Toronto Container Gair Company, Toronto, they solved this with 30 Armstrong Traps that reduced heating up time on a corrugator by 20%. P. S. Temperatures were more even and back pressure was reduced.

ANNUAL REPAIR COS $0.006 PER TRAP. (File 4-4 After five years service at th Blind Floral Company, Pittsburgh the repair cost on 165 Armstrong Traps had totaled fifty cents! You might not do as well, but this record needs no apologies even if the traps were handled with kid gloves and fed vitamins.





ARMSTRONG

INVERTED BUCKET STEAM TRAPS

More Than a Million in Use! • *Sold through leading distributors and jobbers everywhere.*

tween bunkers and stokers, in dryers at the back of the boiler, heated by flue gas circulated around them.

Boilers stand in pairs, Fig. 7, and the gas from each pair passes to a self-supporting 13-ft 3-in. chimney, 128 ft high measured from the base, which is 42 ft above the firing floor. Induced draft is supplied by a 180,000-cfm 70-in. fan, direct connected to a 120-hp 360-rpm motor. Bearings are cooled by filtered water, which is afterward distilled for boiler-feed makeup. Boiler-house auxiliaries, except feed pumps, are electrically driven.

Ash Disposal

Ashes and clinkers collect in two hoppers under each furnace, from which they are conveyed by an exhaust system through piping to receivers outside the boilerhouse. An extension collects fly-ash from the chimneys. Ashes in the receivers are quenched by water sprays and then discharged through a water-sluicing system.

Turbines are 12-stage impulse units operating at 3000 rpm. with steam at 250 psi and 650 F, but they deliver full load if the pressure drops to 225 psi and temperature to 600 F. Guaranteed full-load steam consumption, under normal conditions with 28½-in. vacuum, is 11.6 lb per kwhr.

First installation, Fig. 5, totaled 62,500 kw. in five 12,500-kw 90%-pf 11,000-v 3-phase 50-cycle generating units. Since then capacity has been increased to more than 200,000 kw. Main turbine-generators were built by Metropolitan Vickers Electric Co. of England.

First addition was three 25,000-kw generators with the necessary boilers, auxiliaries and switch gear; the second was a single 50,000-kw unit and boilers. More recent additions consist of several large units operated from boilers of recent design, all equipment being made in Australia.

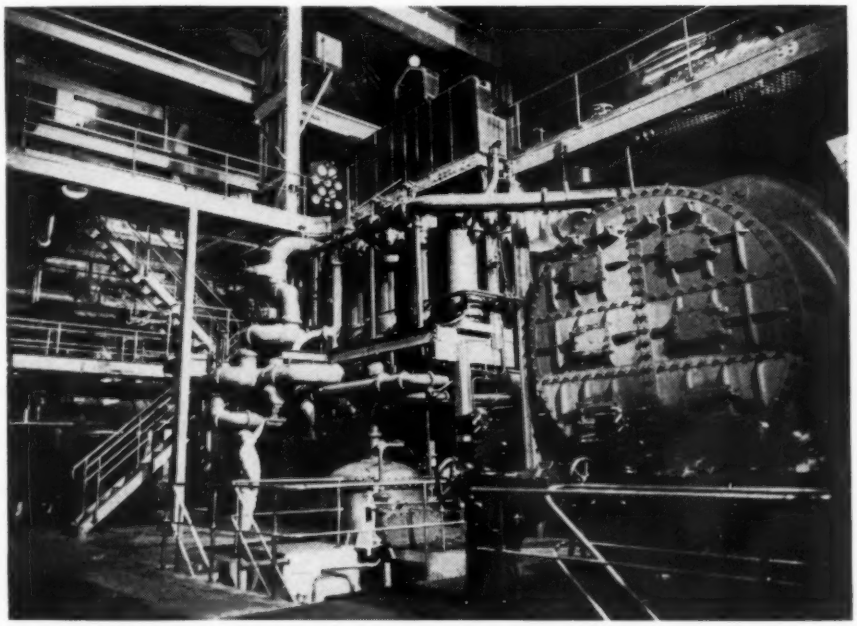


Fig. 6—Makeup water, after being filtered through fiber mattresses, is distilled in quadruple-effect marine evaporators. Condensate goes to hotwell

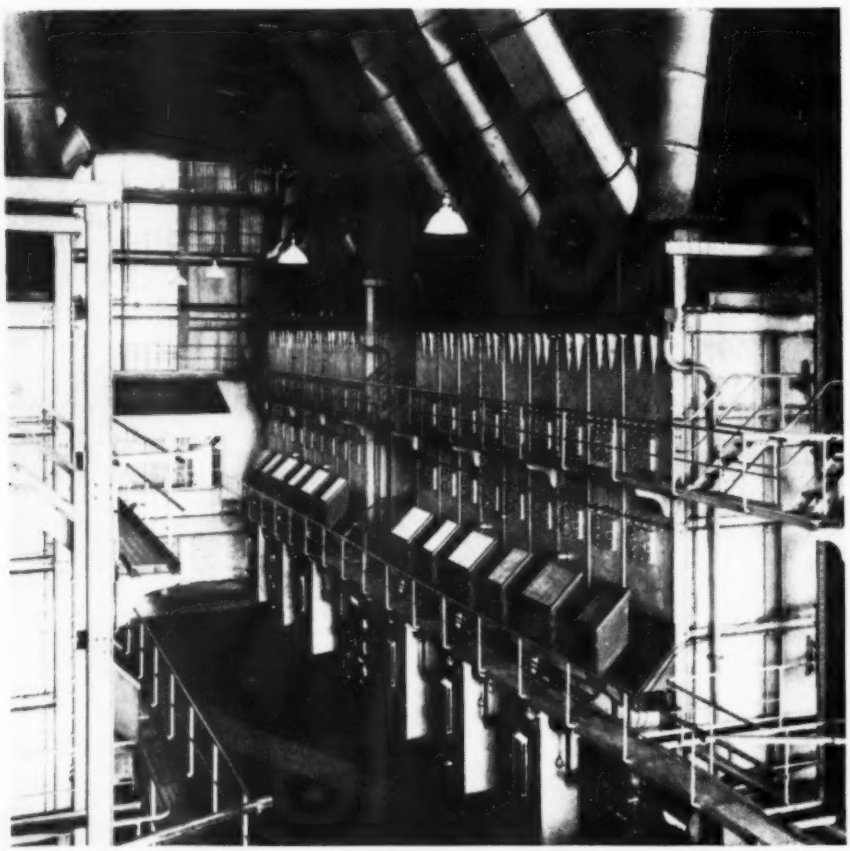


Fig. 7—Boilers stand in pairs, which have a common chimney. Initial coal drying occurs in driers behind the boilers, heated by circulating flue gas

Water Supply

Cooling and makeup water comes from a weir reservoir in the Latrobe River. Makeup water is filtered through fiber mattresses and stored in steel tanks before being distilled in vertical marine type quadruple-effect evaporation, Fig. 6. Evaporators were constructed in the nearby shops at Newcastle, New South Wales.

The briquetting factory dries and briquettes the brown coal, thus producing a fuel suited for domestic and industrial uses. The domestic form consists of large cakes, or bricks, for fireplaces, whereas the industrial form is smaller. This project supplements the state of Victoria's domestic wood fuel, leaving the rich bituminous fields of the other eastern states for the metallurgical industry, shipping and railways.

Yallourn is an excellent example of an engineering project, designed so that the original installation would become an integral part of the final plant. It is a completely integrated development of mining, fuel improvement and power generation under one management.

The *Stake* of the United States in Expanding World Trade

WITH the war in Europe racing to a climax, and with a sure pattern for the defeat of Japan already outlined, American business is confronted with the need for an immediate decision on long-term economic policy.

What is this country's foreign trade program to be after the war?

No intelligent appraisal of all the factors any longer can allow us to postpone considering the issue merely because, in the past, foreign trade absorbed barely eight per cent of our production.

Actually, a whole new set of conditions was injected into the picture by the first World War; but we persisted in ignoring these new factors.

Almost overnight, the United States was transformed from the largest debtor nation in the world to the second largest creditor nation. At the same time, we made faster technological progress than any other nation. Thus we created the need for more dollar exchange on the part of the rest of the world and simultaneously made it harder for other nations to earn dollars.

Today, as another, far vaster war is approaching its end, those changed circumstances are magnified. America has new responsibilities—to itself, and to the world.

Our war-inflated industrial capacity cannot be allowed to drop back to prewar levels without causing a domestic crisis which we dare not permit.

And, because so much of the world is geared to the American industrial machine, we can no longer contemplate calmly the repercussions of a largely self-sufficient trade program or of an unplanned foreign trade program. Either would inevitably set the stage for the next world war.

☆ ☆ ☆

If we are going to prepare ourselves intelligently to cope with this new problem, we must acknowledge certain basic principles.

World trade cannot be rebuilt simply by attempting to restore *prewar* flows of goods. The war has so completely changed the economic fiber of many countries that it is necessary to develop *new* trade relationships. The East Indies, for example, may find the demand for their rubber considerably reduced; the United States may, to a large extent, have to cease exporting cotton; Japan will need to find new substitutes for much of its exports of silk; the British will need new markets to replace the income which they formerly derived from their large overseas investments.

We cannot expand markets for our goods, at home or abroad, unless we find ways of buying more supplies from more people at home or abroad, so that they will have more dollars to spend.

And we probably cannot create increasing buying power abroad without first exporting more of our technical skills—our engineers, our production and management men—to build new markets for our own specialties.

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What is needed to rebuild the world's economic system?

1. Most basic of all, of course, are stable governments which command popular support. In the absence of strong governments, currency stability cannot be achieved.

2. Most war-stricken countries, for a year or two, will need rehabilitation loans, because they will require far more raw materials, equipment, and live stock than they can pay for out of current production.

3. Loans, however, are only a stop-gap, though often a necessary one. Far more important than rehabilitation loans will be the creation of better opportunities for war-stricken countries to sell to the rest of the world, particularly to the United States, South America, South Africa, and India. The ravages of war do not completely destroy the ability of a country to sell. Indeed, it is surprising what large supplies of certain commodities war-torn countries have on hand even before devastated industries have been restored. The invading troops in Normandy found shoes almost non-existent, but they found food more plentiful than in Britain.

   Better opportunities for war-stricken countries to sell would create opportunities for them to buy the things they will require to restore scattered industries and depleted farms, and would help those countries to get rid of the exchange controls which are now universal. So long as a country is able to expand its exports only slowly and painfully, and is dependent upon foreign loans to prevent the depreciation of its currency, so long will it carefully preserve exchange controls and other restrictions in imports. That is why large advances, either through an International Monetary Fund or an International Investment Bank, can make only limited contribution to the removal of trade restrictions.

4. Permanent monetary and credit arrangements are needed to protect nations against temporary pressure upon their currencies, to permit necessary changes in exchange rates to be made in an orderly manner, and to assure that governments never again will repeat the "beggar-my-neighbor" policies of 1931 and 1932.

5. Finally, the world needs a reversal of the trend toward economic self-sufficiency, which received a strong impetus from the first World War and an even stronger one from the great depression of the Thirties. This does not mean that the efforts of many raw-material producing countries to diversify their industries should be opposed. During the late Nineteenth Century and the first part of

this century, the international specialization of production was carried too far, with the result that many countries became dependent for a large part of their standard of living upon the export of one or two raw materials—coffee, sugar, rubber, silk, wheat, wool, and meat. Between the two World Wars, however, the pendulum swung much too far in the direction of self-sufficiency. Some densely populated industrial countries of Europe (Italy, France, and Germany) even attempted to become self-sufficient in wheat, fats, and sugar. So limited are the natural resources and technical skills of most countries that each one finds many things which it can produce only at prohibitive costs. Between the extreme specialization of the late Nineteenth Century and the more recent trend toward extreme self-sufficiency, a happy medium should be sought.

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What role should the United States play in reconstructing the world's international economic system?

There are those who suggest that the United States be a more or less permanent Santa Claus. They believe that an excess of exports could be financed only by "loans"—loans that would eventually turn into gifts, after producing bitter controversy over why the "debtor" country did not meet its obligations. The persons who assert that full employment can be provided only by an excess of exports are in effect saying that our economy cannot become self-supporting. That is a confession of economic defeatism which a young and vigorous nation should not be willing to make.

The most immediate contribution which the United States can make to world reconstruction is to make itself prosperous.

Prosperity here means a large demand by our industries for imports. The more we import, the easier will it be for foreign countries to meet their large and urgent needs for goods. In 1939, with a gross national product of $100 billion, our imports were $3 billion. After the war, with 55 million people employed and a gross national product of $155 billion, our imports would be about $7 billion or $8 billion.

Not only should the United States make itself prosperous, but it should *keep* itself prosperous. *So important is the United States in the world economy that a depression here is bound to produce a disastrous drop in the price of raw materials throughout the world and to throw most countries into an economic tailspin.*

The United States should support the principle of a large fund to protect the exchanges of the world from temporary pressure. We should not permit differences over the details to prevent its establishment in ample time to be available during the critical period when war-stricken countries will need goods far in excess of their immediate ability to pay for them. *Some* arrangement, even though imperfect in details, will be infinitely superior to no arrangement.

Finally, the United States should take the lead in breaking down barriers to trade. We are the logical country to do this, partly because of our immense domestic market, and partly because for most of the last twenty-five years this country has been able to sell other countries more goods than they have been able to sell to us. One of the greatest contributions which the United States could make to a sound and expanding world economy would be to bring our imports, as soon as practicable, up to our exports. *In other words, the United States, in the long run, should be hard to borrow from but easy to sell to.* The United States should implement this policy (1) by continuing the negotiation of reciprocal reductions in duty, and (2) by accepting exchange rates which make foreign currencies cheaper in dollars than they were in 1939. So great will be the world's need for goods that we can be sure that any dollar exchange earned by sales to us will be converted into American-made goods and will lead to larger exports.

Time was when the United States obtained about eight per cent of its standard of living by sending goods abroad and bringing back other goods. Before the war, however, we were getting less than five per cent of our living by international trade. If, after the war, we were gradually to raise the proportion of our standard of living obtained by trading with other countries to ten per cent of domestic production, our imports would be about $15 billion or $16 billion a year. Our people would be able to buy many things which they now cannot afford, and scores of countries which export raw materials and luxury products would feel the stimulus of rapidly expanding markets. Their expanded demand for road building machinery, mining machinery, machine tools, agricultural implements, locomotives, railroad cars, electrical equipment, trucks, automobiles, and a multitude of products of our factories would create a million or more additional jobs in our factories.

Although the United States would raise its standard of living by increasing its imports and its exports, it should honestly face the fact that the resulting shifts in production and employment would temporarily be painful for some people. The increase in imports would be in commodities which other countries can produce for less than the cost at which much of our output is produced—such as sugar, wool, copper, some fats and oils, wines, winter vegetables and fruits. The increase in our exports would come from those industries in which our superiority is greatest—particularly the manufacturing industries. Finally it would be advantageous, to the country as a whole, to shift a million or two workers from agriculture, where they earn about 60 cents an hour at best, to manufacturing, where they earn better than 80 cents an hour.

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The very fact that in economic matters the rest of the world is dependent upon the United States, exposes our country to great demands and to envy and misunderstanding. The United States must be willing to help the rest of the world, but its help should take the form of assisting other countries to help themselves. Never in all history has one country had such an opportunity to give the world a rising standard of living, to foster conditions under which peace flourishes. What greater tragedy could there be than to make the sacrifices which we are now making and fail to seize this chance to create a world of hope and opportunity in which the spirit of goodwill among nations is able to flourish.

President McGraw-Hill Publishing Company, Inc.

Fit the Industrial Mask to the Job

Be ready for any emergency! Place masks where they are available quickly, and know how to use them. Here are valuable pointers from B J George, industrial engineer

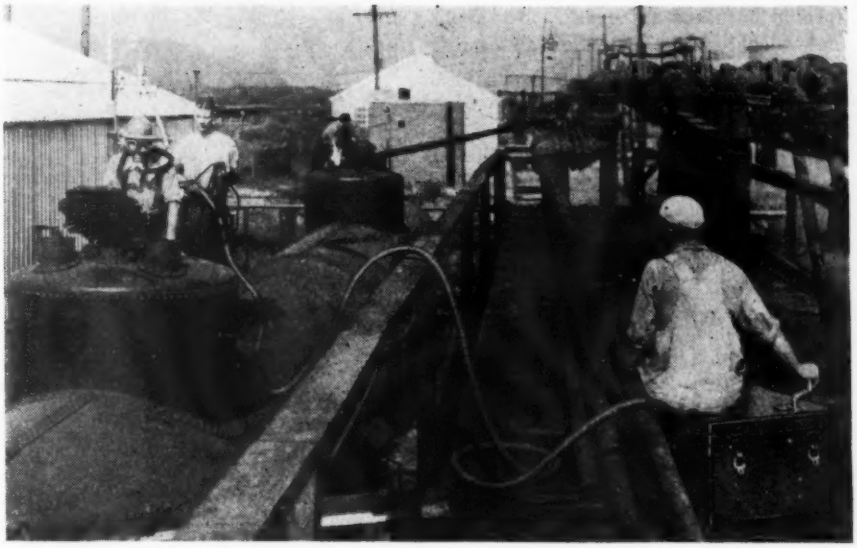


Fig. 1—Hose mask furnishes air to clean and inspect vessels that contain fumes or are deficient in oxygen. Use a blower when supply hose exceeds 75 ft in length

► NEW PROCESSES, new gases and gas combinations continually increase the hazards encountered by power engineers. Thus, high-pressure leaks are more serious when they occur and more difficult to prevent. Other hazards to guard against are introduced by fire-fighting, metal and paint spraying and cleaning with volatile solvents.

A serious failure in machines or pipes carrying refrigerant may injure operators or seriously damage plant products. Failure to provide suitable respiratory protective equipment delays shutting off the break and clearing the area of escaping gas.

The type of mask or respirator needed depends upon the kind of gas or fumes present. How many to provide depends upon local circumstances. At least two are recommended so that the operating engineer, or repair man, and helper are each equipped. Always provide extra canisters.

Protection Limits

A gas mask or respirator protects only the respiratory organs and then only in gas concentrations not exceeding 2% (3% for ammonia). If a fresh canister heats quickly, the presence of a greater concentration is indicated. Be on the alert when entering overly contaminated areas because exposed skin areas may be seriously burned. Also, watch out for gases similar to hydrocyanic acid that may be absorbed through the skin.

Manufacturers deliver canisters with top and bottom openings sealed. Keep seals intact until the unit is needed. Record on a time card how long the canister is used, and reseal it between periods. All-service canister hose attachments carry a timer in which a hand moves around its dial in two hours of breathing time. One revolution indicates the expiration of a canister, and then a new one must be attached.

Available respiratory protective equipment include canister masks, hose masks, self-contained oxygen apparatus, and dust, chemical fume and airline respirators, as follows:

Canister masks protect the respiratory organs against poisonous industrial gas, vapor or dust, whether occurring singly or in combination in relatively low concentrations, provided the contaminated area contains *sufficient oxygen to support life.*

Hose masks, with or without a blower, furnish fresh air from the outside atmosphere to men working in highly concentrated gaseous or oxygen-deficient areas, such as tank cars and oil tanks.

Self-contained oxygen breathing equipment furnishes an adequate supply of oxygen direct from the apparatus carried by the wearer.

Dust and chemical-cartridge respirators protect against dust particles in dusty locations and gas or vapor encountered in paint spraying or cleaning with solvents. Furnished with special filters, this equipment protects against fumes given off by molten metal or from welding.

Photographs courtesy of Mine Safety Appliance Co

Fig. 2—The gas mask protects against low gas concentrations in normal air

Learn by Doing

The air-line respirator furnishes filtered air at low velocity and pressure from a compressed-air source.

Persons required to use a mask should practice putting one on, testing and storing it properly. It is a simple matter to create a sample contaminated atmosphere in an isolated room. (Lighted sulphur candles test an all-service canister.) Install a temporary door and window to observe the occupant while he is inside. Candidates for training should not expose themselves to even the faintest trace of gas before wearing the mask because the odor remains in their nasal passages. After properly adjusting the mask have the wearer enter and spend several minutes in the contaminated atmosphere.

Place masks and spare canisters in an easily accessible and gas-free spot, adjacent to the danger zone. Putting them in the engine or process room where a break may occur handicaps an operator. If a mask must be placed in

a danger area (to be quickly available) have at least one more outside such area.

Storage should be on permanent shelves or brackets and always in a specific location. If masks are kept under lock and key, provide an easily broken glass door. Instructions on the box or shelf should indicate where to find other masks and spare canisters. Paint the shelf red and letter "Gas Masks" on its back wall to indicate visibly that the mask is not in its proper place. Put the shelf in a cool, dry place away from steam pipes or other hot objects.

It is not enough merely to provide suitable, workable masks—they must be kept in proper condition by periodic tests and inspection. Check parts carefully. Examine for leaks and cuts in rubber and fabric, broken or weakened straps and metal parts, broken glass, and other signs of deterioration. Examine the canister seal. Discard old and doubtful canisters and provide fresh ones.

When inspecting, put the mask on, adjust and test it by (1) closing the intake and inhaling, and (2) breathing naturally with the intake opening free. With closed intake the face piece should collapse, thus showing that it does not leak. With intake open, inhaling and exhaling should be free and easy with the exhaled air passing out through the outlet valve. Only way to determine whether a used canister has any life is to try it in a gaseous atmosphere.

Keep Mask Sanitary

Before putting a mask away, prepare it for storage according to manufacturer's instructions. To prevent passing disease or skin irritation to the next user, sterilize the face piece by washing the rubber and metal parts with warm water and a good soap, then rinsing thoroughly in clear water. Solvents such as gasoline, naphtha or carbon tetrachloride damage rubber parts. Sunlight also damages the rubber.

Suggested disinfectant solutions include: one part of 40% formaldehyde solution in nine parts of water, a 2% Lysol or cresol solution, a 70% solution of ethyl alcohol, or a 3% solution of carbolic acid. Sterilize all parts that touch the face or are exposed to exhaled air for at least ten minutes, then rinse and dry thoroughly. Warm air is best for drying. Before storing, seal the canister.

Always use the mask promptly for all but minor leaks because long exposure may be fatal. Do not pull up head harness too tightly or unevenly.

Fig. 3—Self-contained oxygen breathing device furnishes the wearer with oxygen

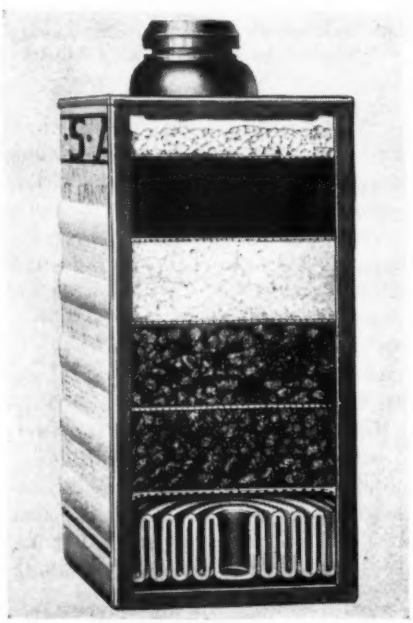


Fig. 4—All-service canister with variety of chemicals and cellulose filter

Uneven adjustment creases the face piece and causes a leak.

Upon entering a contaminated region, immediately test the mask and make necessary adjustments. Odor, taste, and eye, nose or throat irritation are evidence that the mask has a leak or the canister is dead. Sometimes after using a mask for long periods the chin or other parts of the face may be irritated. An application of petroleum jelly or ordinary face cream relieves the discomfort. Do not use products that damage the rubber or fabric.

The usual gas mask does not create oxygen; hence it does not protect against asphyxiation where there is insufficient oxygen to sustain life. Therefore, proceed cautiously. If in doubt, test with a safety lamp before entering an inclosure. Remember that other gases may be present to cause an oxygen dilution or deficiency; this is often true when carbon monoxide results from a fire.

Here are the approximate toxic qualities of ammonia, carbon dioxide, carbon monoxide, sulphur dioxide, Freon, methyl chloride and hydrogen sulphide:

Ammonia, in concentrations of 0.01%, causes slight symptoms after several hours exposure. Concentrations of from 0.03 to 0.05% can be inhaled for one hour, whereas 0.25 to 0.45% is dangerous in one-half to one hour. Exposure to 0.5 to 1.0% may be quickly fatal.

Carbon dioxide, a heavy gas normally occurring in the atmosphere, causes laborious breathing with concentration of 5%; 10% cannot be endured more than a few minutes.

Deadly Carbon Monoxide

Carbon monoxide, a product of imperfect combustion and a deadly gas, produces, in small concentrations of 0.01 to 0.02%, slight symptoms over a period of several hours. An exposure to 0.04% for two or three hours usually causes headache and discomfort. Moderate exercise in a 0.12% mixture causes heart palpitation in half an hour, staggering in one and one-half hours, headache and mental confusion in two hours. Concentrations of 0.20% and above cause unconsciousness within 30 minutes; quantities above 0.25% mean almost instant collapse.

Sulphur dioxide can be poisonous in small concentrations but its irritating characteristics make breathing intolerable before dangerous conditions exist. Concentrations of 0.001% cause slight symptoms in several hours; 0.003 to 0.005% may be inhaled several hours; 0.04 to 0.05% may be dangerous in 30 to 60 minutes, and high concentrations are quickly fatal.

Freon (F-12) is nontoxic and nonirritating.

Methyl chloride causes slight symptoms after several hours' exposure to concentrations of 2%; 4% may be endured about one hour; 6 to 10% may become dangerous in 30 to 60 minutes; 15 to 30% is quickly fatal.

Hydrogen sulphide, in concentrations as low as 0.005%, may produce subacute poisoning, and in concentrations as low as 0.07%, probable collapse within a short time.

Chain Solves Tough Drive Problem

Four 5-strand finished-steel roller chains, with three clutches and a silent-chain sprocket, connect either, or both, of two 635-hp diesels to a tug propeller and one engine to two fire pumps

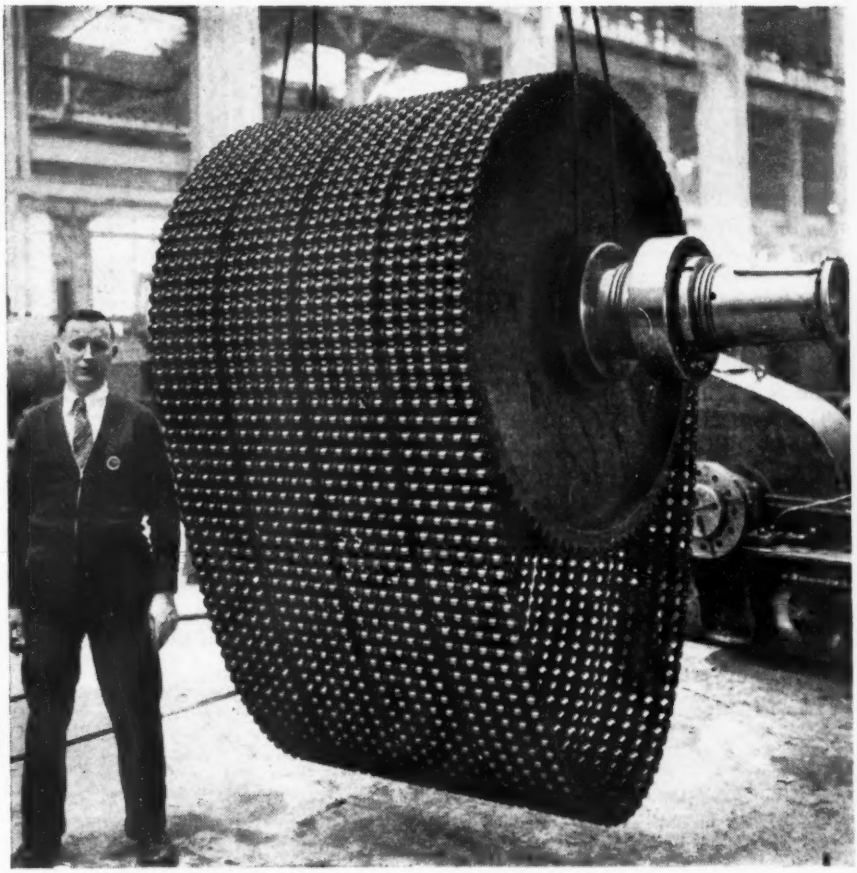


Fig. 1—These four 5-strand 1¾-in.-pitch finished-steel roller chains, one of the largest drives of its kind, transmit 1300 hp from two 635-hp 630-rpm diesels to tug propeller

▶ MANY AND INGENIOUS are the combinations of mechanical power-transmission equipment used to connect power units to their loads and to obtain the desired degree of flexibility and control in the drive. For many applications, a simple flexible coupling, chain drive, gear or belt is all that is needed. In others, to meet complicated load requirements, chain drives of different designs, cutoff-coupling and power-takeoff clutches, flexible couplings and hydraulic couplings may be required, as in the units described here, used on U. S. Navy 110-ft diesel-engine-driven harbor tugs.

Fig. 1 shows one of fourteen 1300-hp multiple-strand finished-steel roller chains with one of its sprockets mounted on the output shaft of a Morse Chain marine power-transmission unit, Fig. 2. Each drive consists of four 5-strand, 1¾-in. pitch chains of special precision design. The chains, used in pairs, connect the two input shafts of the transmission unit to its central output shaft.

Sprockets on the power-input shafts have 30 teeth and are 16.5 in. in diameter, while those on the output shaft have 95 teeth and are 53 in. in diameter, giving a 3.2:1 speed ratio. Each power-input shaft connects through an American Blower hydraulic coupling to a 635-hp, 630-rpm Enterprise direct-reversing diesel engine.

The hydraulic couplings provide flexible connections between the engines and the transmission units. They also prevent shock being transmitted from engines to the transmission unit and from the propeller to the engines. At full engine speed, chain speed is 2700 ft per min and propeller shaft speed 193 rpm.

Each engine shaft of the transmission unit has a cutoff-coupling dental-type clutch that permits connecting and disconnecting the engines at will. Because the tugs are of wood it was considered

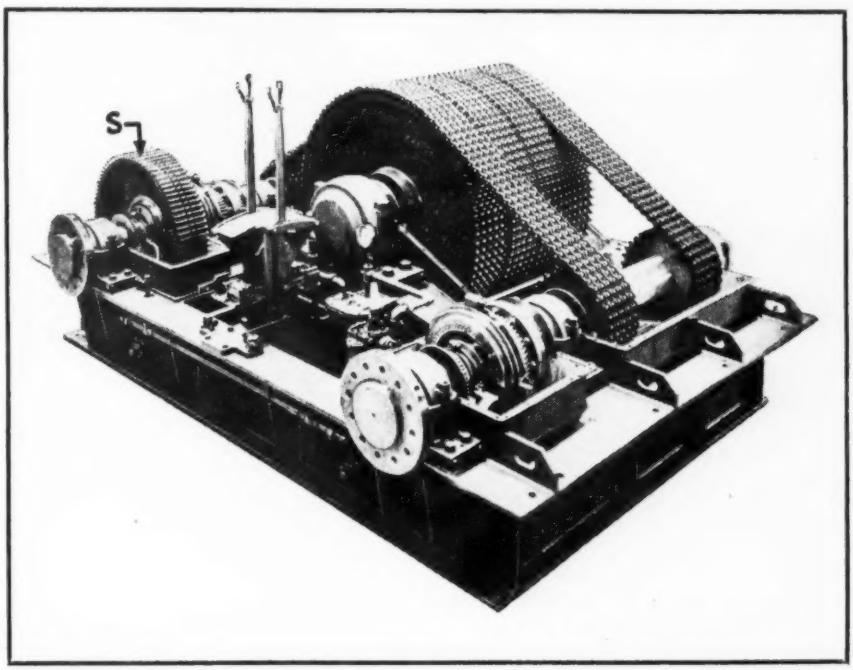


Fig. 2—Power-transmission-unit assembly shows how each 650-hp pair of 5-strand chains connects to the two engine shafts, each of which includes a friction clutch. Silent-chain sprocket *S* connects by an 8-in 500-hp chain to two fire pumps

advisable to connect the transmission unit to the propeller shaft by a flexible coupling.

The starboard shaft has a power-take-off silent-chain sprocket combined with a friction clutch to transmit 500 hp to two fire pumps by a Morse silent chain. This chain, 8 in. wide and 1¼ in. pitch, drives these pumps at 2000 rpm. The clutches make it possible to operate the tug with either engine, or both. When the fire pumps are driven by one engine, the other may be used for tug propulsion. To facilitate quick reversal of the engines, which are of the direct-reversing design, a brake is provided on the propeller shaft. Fig. 3 shows one of the transmission units completely assembled and inclosed, ready for installation as a unit.

The shafts run in self-aligning anti-friction bearings and positive lubrication is supplied to the chains, clutches and bearings by two 8-gpm pumps.

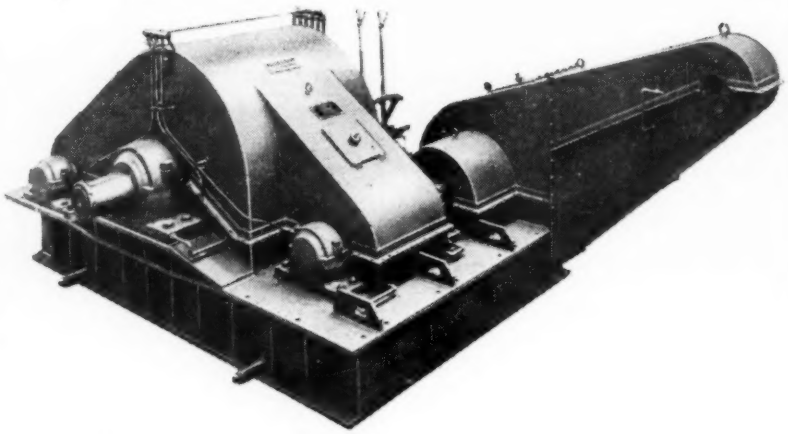
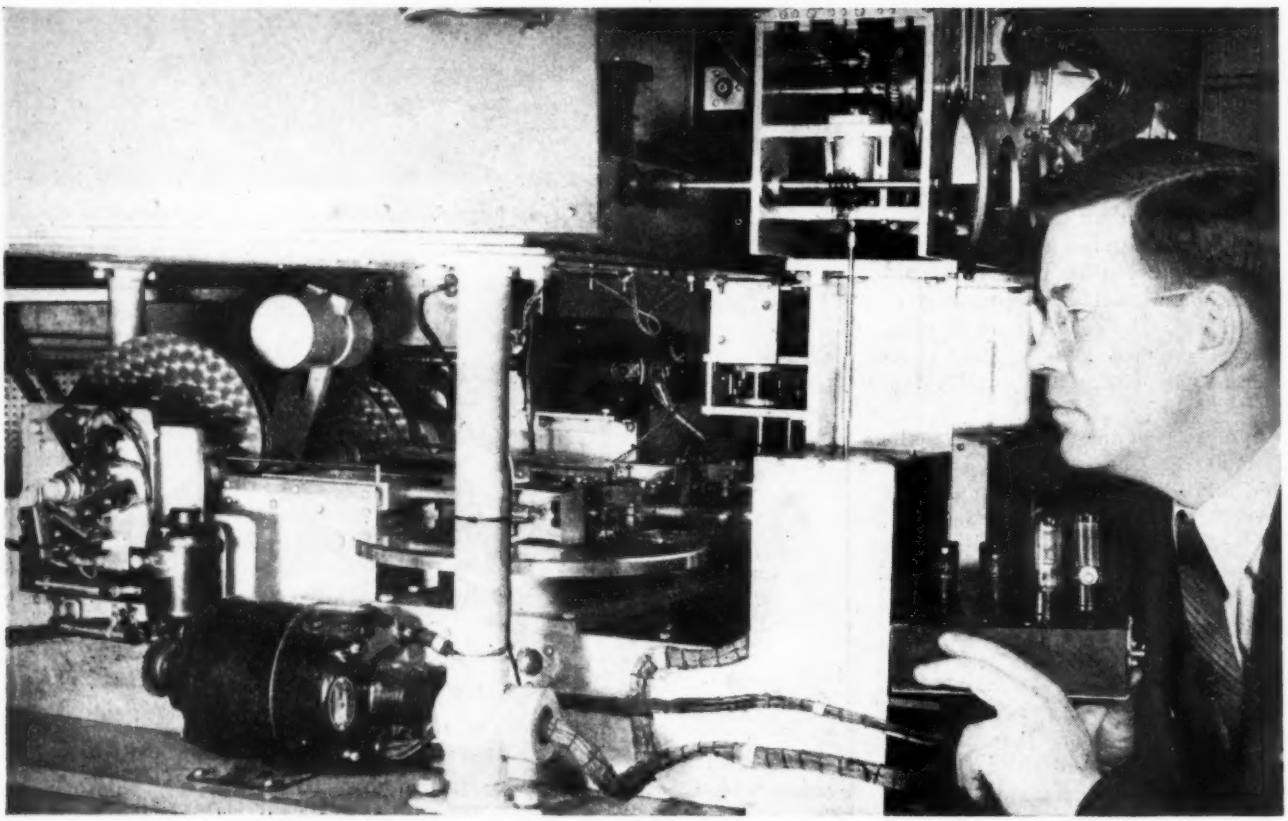


Fig. 3—Transmission unit assembled and completely inclosed, ready for installation, has its chains, clutches and bearings positively lubricated

Mechanical "Brain" Saves Power for War



More power from less fuel is the objective of this calculating machine described recently by T M Berry, General Electric engineer, at the AIEE meeting. The device tests samples of turbine nozzles, which must be super-streamlined for maximum efficiency. Compressed air, in place of steam, is blown at various pressures through a nozzle sample and the machine measures, records and adds energies at various nozzle points. The phonograph-like disk, center, turns and the varying pressures move the tiny upright wheels back and forth on it. Rotating shafts of light, instead of customary metal shafts, convey motion of the wheels. The tiny light shines through a polarizer to photoelectric tubes (at Mr Berry's left hand in photo) which control a series of cams and gears operating the printer (above Mr Berry's head and opposite the raised cover, left). The printer adds up energies and indicates over-all loss, data which becomes the basis of turbine improvements

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Scrap and 'Know How' Built This Evaporative Condenser

Midwest plant lacked funds for a condenser to convert exhaust into makeup, so some used boiler tubes and engineering ingenuity produced the needed feedwater

BY OSCAR MARQUARDT
Master Mechanic
Illinois State Penitentiary
and
GEORGE HOLMAN,
Refrigerating Engineer

THE POWER PLANT of Illinois State Penitentiary's Menard Division needed a condenser to convert wasted steam into boiler feedwater. For 40 years the plant had operated on a non-condensing basis. Mississippi River water, containing an average of 160-ppm scale-forming impurities was filtered and treated with soda ash for boiler feed. Tubes that scaled badly and failed frequently, foaming and carryover that occurred in spite of frequent blowdown—all added up to a highly unsatisfactory condition.

A new feedwater treatment proved successful, but was costly. The necessary appropriation could not be secured for recommended condensing equipment. With some justification, the state engineer and purchasing agent cited the need to use part of the exhaust steam continuously for heating institution water, and exhaust plus considerable live steam for building heat during cold months. A water report for the first day of the heating season shows a marked reduction in makeup requirements over periods when the only condensate came from water heaters, laundry and cooking kettles. The answer was to save water with a homemade condenser rather than to produce a vacuum on the prime-mover exhaust.

With the boiler inspector's permission, an atmospheric condenser was built from 200 old boiler tubes. Faulty

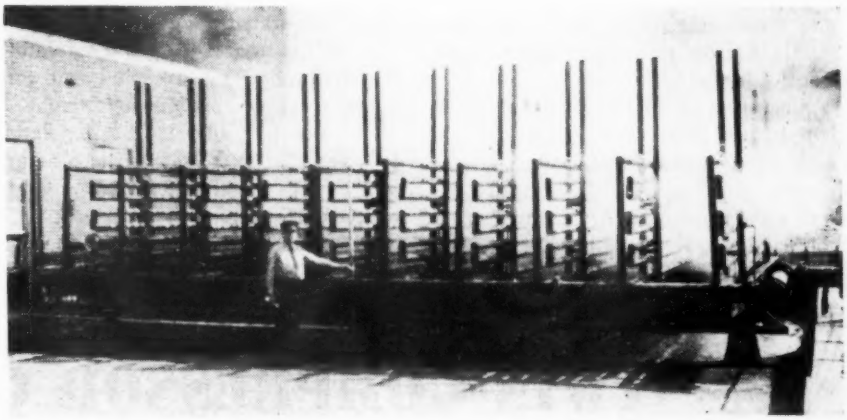


Fig. 1—Initial condenser unit in operation. More sections will be added. Alternate wetting and drying, heating and cooling remove scale from the pipe

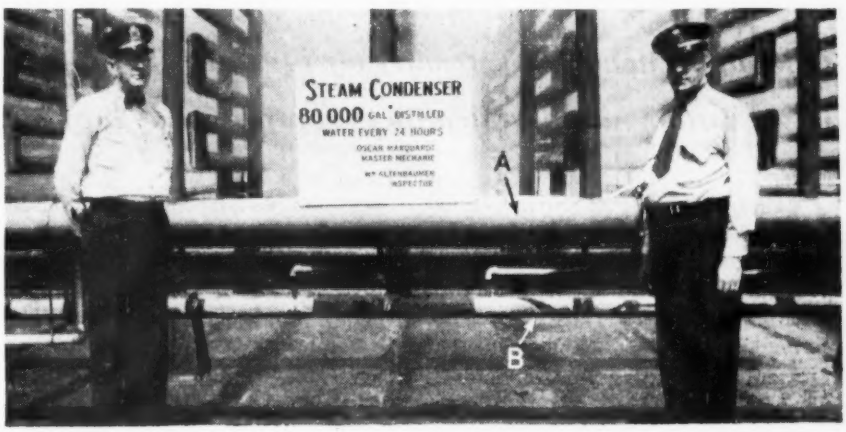


Fig. 2—Chief Engineer E Meinert, left, and Master Mechanic O Marquardt, designer, right. Individual risers feed each unit with return into lower pipe

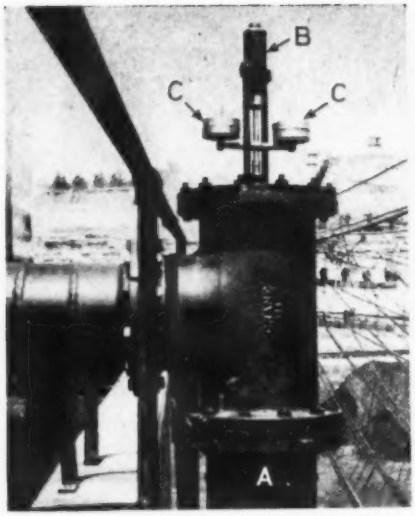


Fig. 3—Regulator prevents hogging steam from the feedwater heater

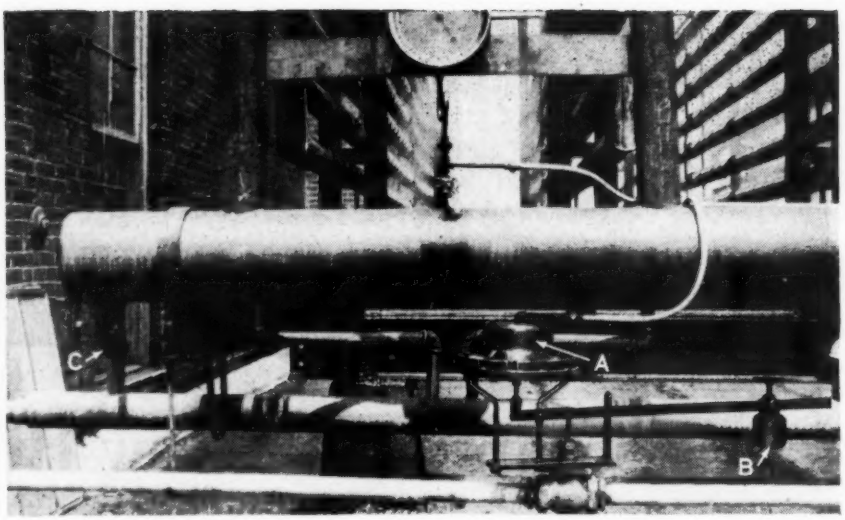


Fig. 4—This homemade regulator controls water flow to the condenser. Sliding weight B along the lever arm adjusts operation for correct steam pressure

sections were cut out, and the undamaged parts arc-welded in position on the engine-room roof. Tubes were arranged in ten stands of eight tubes each, Fig. 1, to form 2700 sq ft of heat transfer surface.

Each stand of tubes connects independently into exhaust-steam header *A* and condensate return *B*, Fig. 2. Riser *A*, Fig. 3, from an underground exhaust line feeds the steam header.

Since part of the exhaust steam must supply two large closed water heaters and an open feedwater heater, it was necessary to regulate the quantity entering the condenser. A machinist made the dead-weight regulator, Fig. 3, from a 10-in. tee. Oil-filled dashpot, *B*, on the end of valve stem prevents noisy operation. On light loads the valve prevents a vacuum in the condenser from taking away exhaust steam needed to heat feedwater.

Condensing water comes from the institution mains. To insure minimum waste, flow is controlled by a diaphragm-operated regulator, *A*, Fig. 4. The body is from a discarded regulator; diaphragm housing, yoke and arm were made from scrap. Moving weight *B* along the bar adjusts the regulator. It is actuated by header steam pressure and applies water when that pressure exceeds 0.5 psi.

A vacuum breaker placed on the condensate line, and one 1/32-in. hole drilled in the top tube of each stand prevent negative pressure when load falls off rapidly. A small thermal trap, *C*, drains the header into condensate return line. Condensate discharges to the hotwell through a converted dual-pressure trap made into a simple float-controlled unit by adding a valve.

Tests show that scale-forming elements in the condensate average 30 ppm, in contrast to 160 ppm for raw water and 80 ppm in the hotwell. Cost of feedwater compound, at 13¢ per lb, reached $1950 in 1943, on the basis of 25 to 75 lb daily. Since most of the compound is used during five summer months, the condenser is expected to save about $1000 a year.

TWIN-COMPRESSOR CONTROL

Improves Air-Pressure Regulation

Operations demanded steadier air pressure. The answer is a 5-step unit controlling compressors in pairs

By F M SWENGEL
Goodyear Aircraft Corp.

OUR AIR COMPRESSOR installation consists of five 2-stage double-acting vee-type units with diaphragm-controlled intake valves. Each machine came equipped with two conventional spring-loaded differential unloaders that give 3-step regulation on a total range of 7 to 10 psi. (See August POWER, page 64.)

To improve air-pressure control, thus assuring uniformity in many factory operations, we adapted two 5-step transformer unloaders to control four of the five units. The fifth retains its original unloaders, modified to permit manual loading or unloading on each step, while the unloader acts automatically on pressure increase or decrease. This machine operates at base load when required.

Adapting the 5-step unloaders did not entail any difficulties except rearrangement of starting-solenoid valves. As Fig. 2 shows, four steps control the two compressors, each having full-, half- and zero-load stages.

Design and adjustment of the 5-step unloader effectively produces plus or minus 1½% pressure regulation at all times. Unit functions as follows:

Small feeler line transmits receiver pressure to the underside of a spring-loaded diaphragm and bellows. Dia-

phragm movement actuates a small throttling valve, admitting a small, variable air flow into a reduced-pressure line fitted with a continuous bleed. Supplying all air actually used in unloader operation by an independent line prevents pressure fluctuation on the diaphragm. Combined action of bleed valve and diaphragm-operated transformer valve produces a variation from zero to full pressure in the reduced-pressure line on a change of 3 to 4% in distribution pressure.

Double-Seat Plate Valve

Each unloader step has a plate valve with upper and lower seats. Valves are held on the lower seat by the combined action of the small diaphragms and a stiff spring. This loads the compressor. As receiver pressure rises, action of pressure transformer causes a drop in pressure on the small diaphragm, allowing line pressure to lift the plate valve to the upper seat, closing the vent line and admitting air through port *P* to the inlet-valve diaphragms. This pressure holds the inlet valves open, unloading the machine. As receiver pressure falls, transformer raises the pressure on the small diaphragm, forcing the valve to the lower seat, which vents the inlet-valve line and consequently loads the compressor. Shim adjustment sets the four steps functioning consecutively as pressure rises or falls in the reduced-pressure line.

For starting, a 3-way solenoid valve connects into the circuit to unload the machine until its synchronous-motor field is energized. When solenoid circuit is energized, the valve shifts position and the unloader functions normally.

Compressor motors are automatically carried through reduced-voltage starting cycle. Auxiliary contactors energize the solenoid when field circuit is closed. Energizing the motor-starter panel control circuit from the exciter mg sets gives positive interlocking.

By adjusting the two 5-step regulators to give minimum variation in pressure it is possible to use any combination of machines and maintain line pressure at plus or minus 1½ psi without adjustment, or special handling.

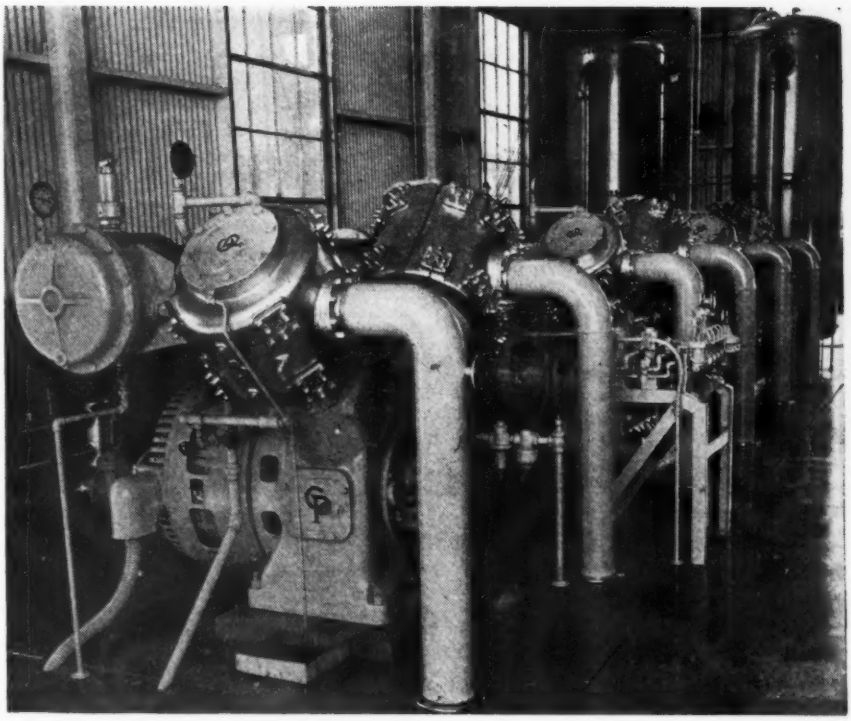


Fig. 1—Two 5-step unloaders control four machines; fifth retains its original 3-step unloader modified to allow manual control on each pressure step

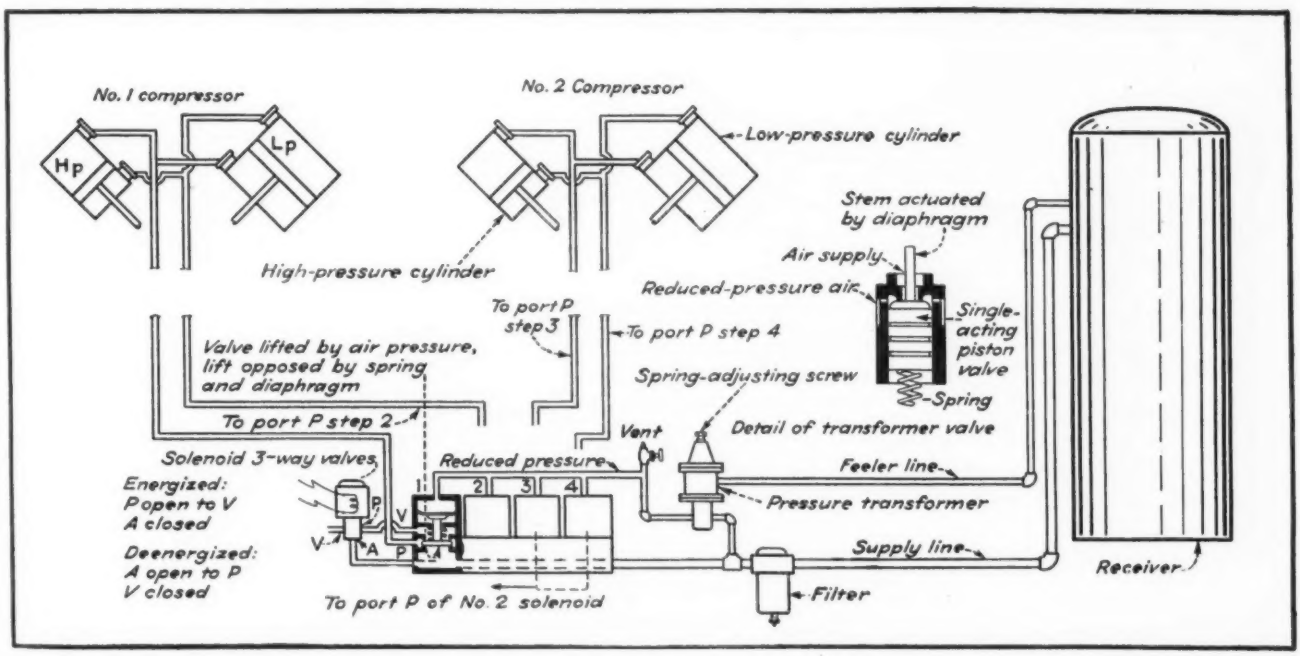
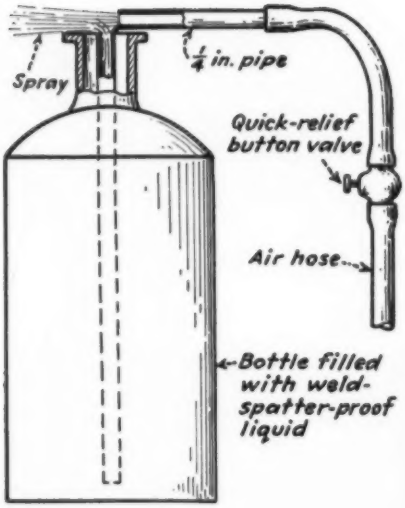


Fig. 2—Automatic transforming valve produces a variation from zero to full pressure in the reduced-pressure line on a change of 3 to 4% in distribution pressure. This gives each pair of compressors a plus or minus 1½% regulation

Plant-Tested Methods and Ideas for Power Men

PRACTICAL Aids



Spatter-Proof Liquid Reduces Cleaning Time

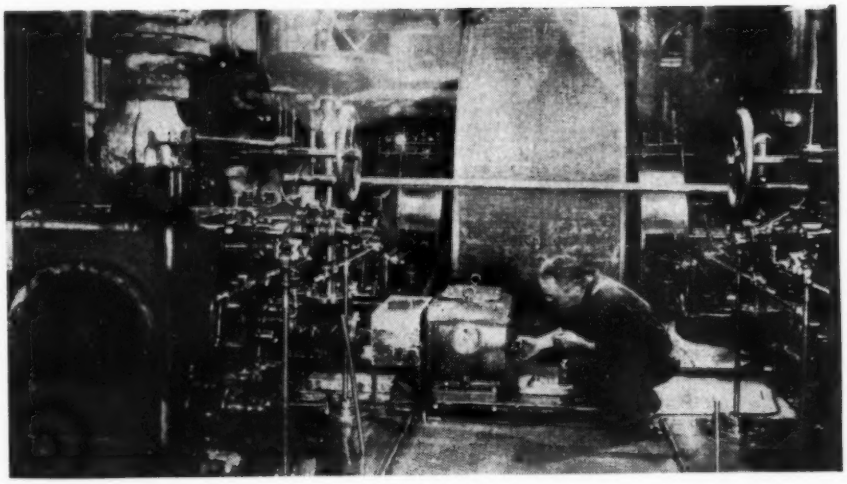
ANY METHOD that saves time and makes work easier is encouraged in our welding department. In the fabrication of welded-steel bases, with numerous ribs welded at right angles to steel plates, the cleaning of weld spatter was an item of considerable cost. This was solved by using a spatter-proof liquid. We first brushed it on the steel, covering about 2 in. on each side of the weld.

Alex Dawson, our welding foreman, decided that brushing was too slow so he designed a simple spray to eliminate it. He cut part way across a ¼-in. pipe with a hack saw, bent the pipe at 90 deg and attached a short piece of rubber hose with a quick opening button valve, as in the diagram. By putting the pipe in a bottle of spatter-proof liquid and attaching the air hose to the bent pipe, he sprays the work.

When the steel bases were sprayed a larger surface was covered by the spatter-proof liquid than when it was brushed on. This led to another labor-saving discovery. After the bases are fabricated they are stress relieved in a furnace.

This heat treatment removed shrinkage stresses in the welded steel, but left an oxide film that made mill scale harder to remove. Dawson noticed that surfaces covered by spatter-proof liquid left the mill scale loose on the steel and made the oxide film easier to remove. Now we completely spray all welded steel structures with spatter-proof liquid before and after welding. Even though they remain in an open yard for several days, waiting their turn to go into the furnace, their surface is protected from rusting. Instead of the usual 3-hr cleaning time per base after heat treatment the time has been reduced about one half and we have a cleaner, smoother surface for the priming paint coat.

Cleveland, O. ROSS YARROW, SUPT
Republic Structural Iron Works



GOVERNOR DRIVE ADJUSTS ENGINE SPEED

BECAUSE OF DIFFICULTY in maintaining correct speed of several corliss-engine-driven paper machines, the Abitibi Power & Paper Co, Sault Ste. Marie, Ontario, decided to install an infinitely variable-speed transmission on the governor drive of one engine, as in the photo. This drive uses a steel chain with laminated-steel teeth that mesh into radial grooves in the face of opposing conical wheels to give a positive drive over the unit's speed range.

To insure that the variable-speed unit's positive-speed ratio is maintained between engine shaft and governor, positive drives are used between them. The unit's input shaft connects to the engine crankshaft by a silent-chain drive and its output shaft couples directly to the governor shaft by a roller-chain flexible coupling. In this drive the input shaft is the one that has its speed varied, and the output shaft operates at constant speed.

The variable-speed unit has a speed ratio of 2 to 1, which permits setting the engine for any speed between 70 and 140 rpm. Speed having once been set, it will be maintained practically constant, because engine speed is correctly interpreted to the governor, by the positive drives. Graphic charts of paper speed in the machine show practically a straight line day after day.

Philadelphia, Pa. J H OAKES
Link-Belt Co

Sticking Brush Reversed Exciter Polarity

POLARITY of dc generators can be accidentally reversed in several ways but this one is unusual. Three steam-turbine-driven ac generators with direct-connected exciters were installed in an industrial plant. One day, when only one machine was running the lamps suddenly went dark and quickly lit again, and the operator discovered that exciter voltmeter and ammeter were reading backward off their scales. This indicated that the polarity of the exciter had been reversed when the lamps went dark.

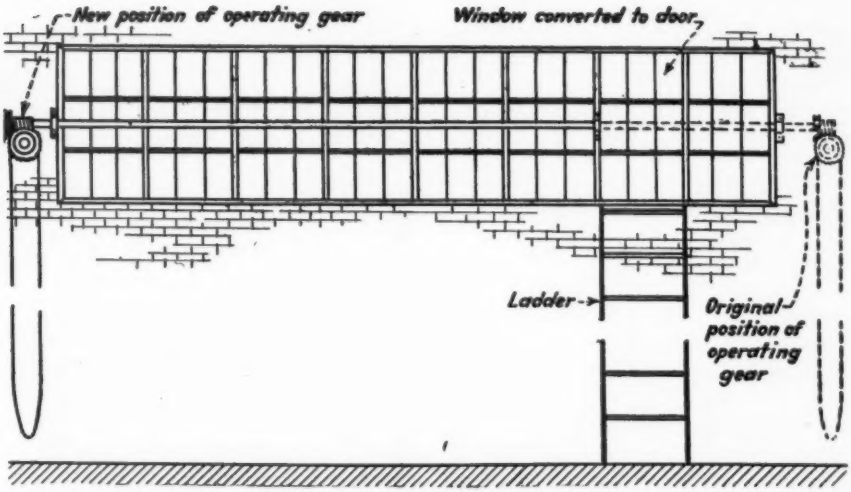
To locate the cause of reversed polarity another machine was put in service and the one in trouble taken off the line. The exciters were small 2-pole machines

to Operation

with one brush in each of two holders. The brushes had collected dirt that made them sluggish in their holders. One of the brushes had stuck clear of the commutator long enough to break the circuit to the alternator's field coils.

When this happened the inductance of these coils maintained a current in a circuit through the exciter field coils in the reverse direction to normal excitation current and reversed the field-pole polarity. When the cause was discovered, the brushes and their holders were cleaned and the machine brought up to the voltage. Then by pulling one of the brushes away from the exciter's commutator and letting it return, polarity returned to normal.

Detroit, Mich. L P CARRY



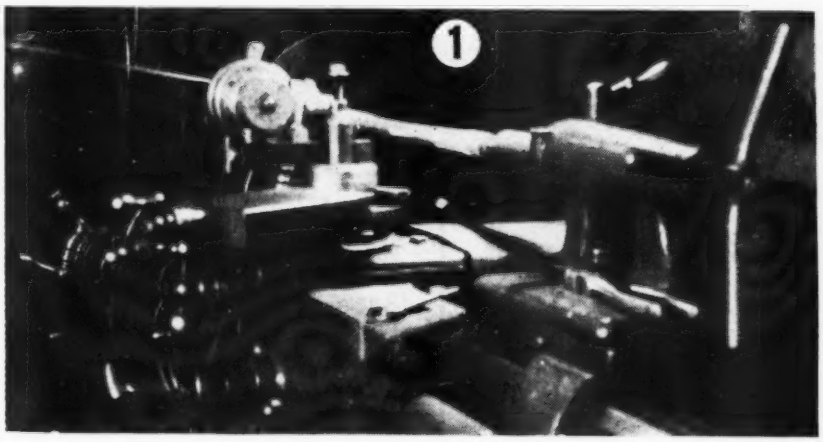
OPERATOR CHANGES REMOVE WINDOW HAZARD

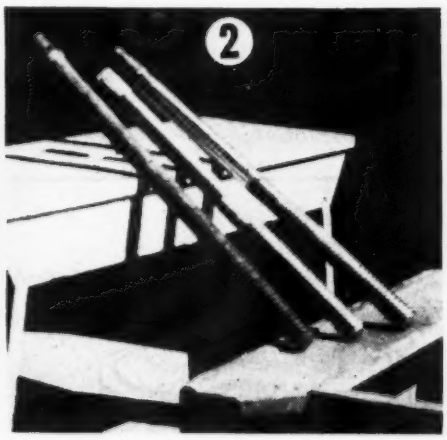
IN ONE POWER STATION a straight ladder up the inside wall to a window was the only means of getting to the roof. Climbing through the half-open window under its shaft was awkward and not too safe.

Fortunately, the ladder ran up to the seventh window of eight operated by a single mechanism. The chain gear for opening and closing the windows was on the end of the operating shaft nearest the ladder, as in the diagram.

We removed the gear and installed it on the left-hand end of the operating shaft and moved the right-hand bearing to the left of the window that gave access to the roof. This permitted us to cut off the operating shaft clear of this window. We then removed the window and converted it to a door that swings out on the roof.

Fairview, N. J. MARTIN N GOZDENOVICH





METAL-SPRAY RECONDITIONS VALVE STEMS

WHEN REPLACING a steel stem in a valve with a bronze or stainless steel one. the change can be made at comparatively small cost by metal spraying on the original stem. A large oil company installed equipment for this in its maintenance shop. After experimenting the shop men could easily cover any valve stem with the required metal or alloy.

They disassemble the valve and clean all parts in a hot-caustic solution, then chuck the stem in a lathe and with a cutting tool remove all pits from the worn section. A threading tool cuts a rough shallow thread, about 25 threads to the inch, along the trimmed section. An undercut at each end of the prepared section forms an overhang to lock the ends of the sprayed alloy to the parent metal.

After preparing the stem for rebuilding, metal coating is applied by a metal spray gun while the stem turns in a lathe, Fig. 1. The gun operator applies as many metal layers as needed to make the stem larger than its original diameter, after which it is machined and finished to the correct diameter.

Fig. 2 shows the three stages of conditioning a valve stem: On the left, it is taken from the valve; in the center, it is turned ready for metal spraying; the finished product is on the right.

Cost depends on equipment, operator and other factors. The oil company mechanic who reconditions the valve

stems can metal spray and finish a stem for a 6-in. valve at approximately one third the cost of a new one.

Santa Monica, Calif. J C ALBRIGHT

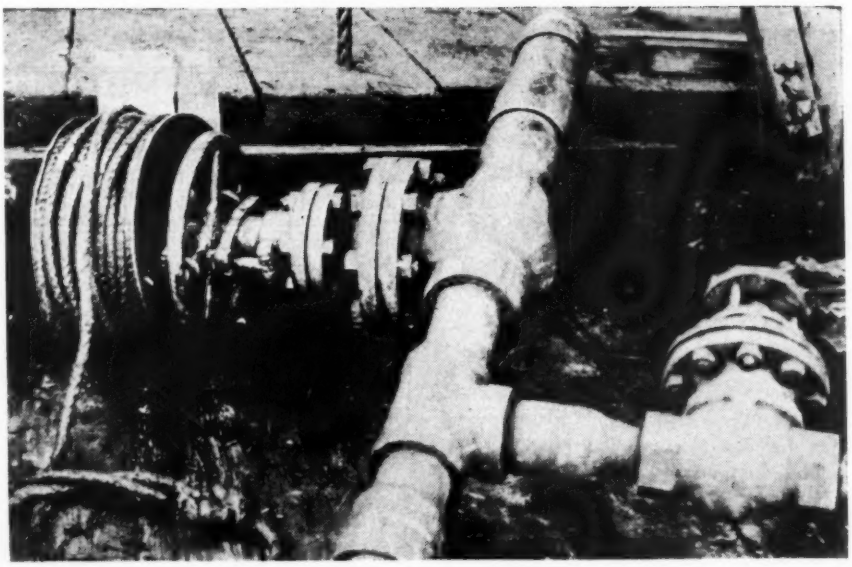
Homemade Hone Trues Engine Cylinder

IN ONE PLANT, equipment was not available for boring the cylinder of a small steam engine. So we did the job with a homemade hone, Fig. 1 and 2, made from a wood cylinder, slightly smaller than the inside cylinder bore, cut in two halves longitudinally. From between the halves we cut a slice about ¾-in. thick. Coarse emery cloth was then fitted around each half cylinder and tacked to the flat surfaces between the two halves, Fig. 1, on the left below.

Two small brass-wire springs, attached to one half of the cylinder and left free at the other end, held the two halves in contact with the engine cylinder bore. A steel plate with a small steel shank welded to it held the two half cylinders together with wood screws.

To bore the engine cylinder we placed it vertically and on a long spiral spring we supported an electric drill with the hone shank in its chuck hung above the cylinder, Fig. 2. The spring permitted the hone to be easily moved up and down over the surface of the cylinder while being rotated by the drill. In about one hour this operation gradually ground the cylinder surface true.

Toronto, Ont. D A BURMA

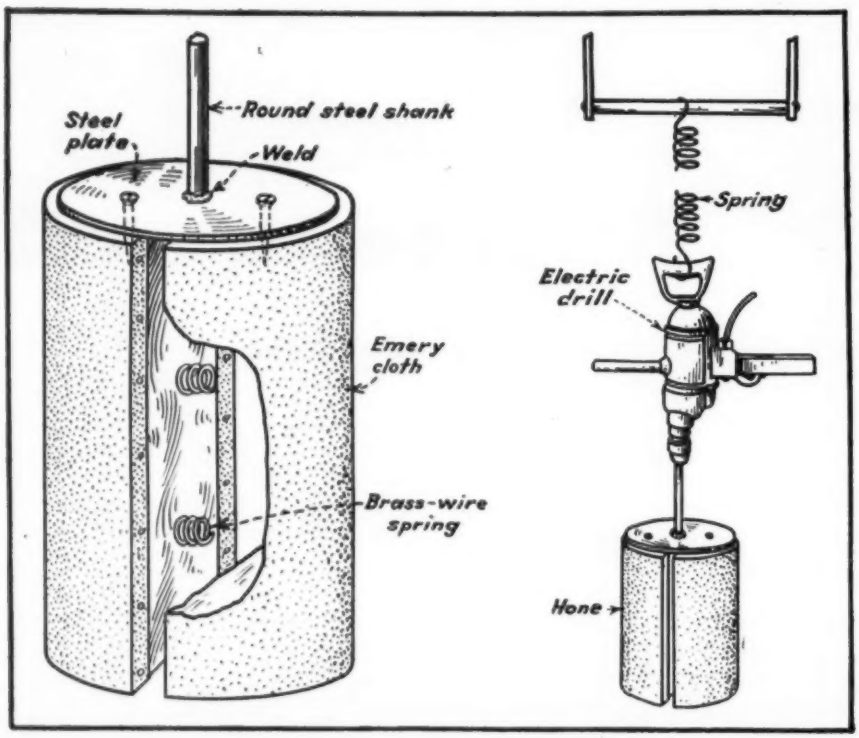


ROPE REEL CLOSES EMERGENCY VALVE

IN ONE PLANT where a gate valve in a 4-in. high-pressure line might have to be closed under emergency conditions, and a remote-controlled electric operator was not available, the job was done as in the photo. A spool made of two 16-in. disks welded to a hollow cylinder is mounted on the valve wheel. One end of a 30-ft ½-in. rope connects to the spool and is wound on it. To close the valve in an emergency one or two workers pick up the end of the rope and run with it as they leave the plant.

Care must be taken to wind the rope correctly on the spool so that when it is pulled the valve closes. This can be insured by winding the rope on as the spool turns when opening the valve. Also take care that someone does not make the packing so tight when the valve is open that it will be difficult to close. Instead of having a workman pick up the end of the rope and run with it as he leaves the plant, the rope may be made sufficiently long to extend outside the emergency area.

Pomona, Calif. G M WILSON



Ammeters Prevent Motor Overloads

AN AMMETER is inexpensive to install and is a most useful instrument even though it is not used as extensively as it should be. If more medium- and large-sized electric motors had an ammeter connected in their circuits to indicate load, there would be fewer motor burnouts. In some applications the load may materially increase because of misalignment or other causes, such as changes in the quality of the material processed. In other applications, amount of load on the motor is controlled by the machine operator. In any of these an ammeter pays for itself in a short time.

In a cement plant the kilns got out of line, overloaded their motors and burned out one motor before the cause was discovered. When this happened an ammeter was installed on each kiln motor. The kilns were properly aligned and the motor load determined under this condition, and this point on the meter scale marked red.

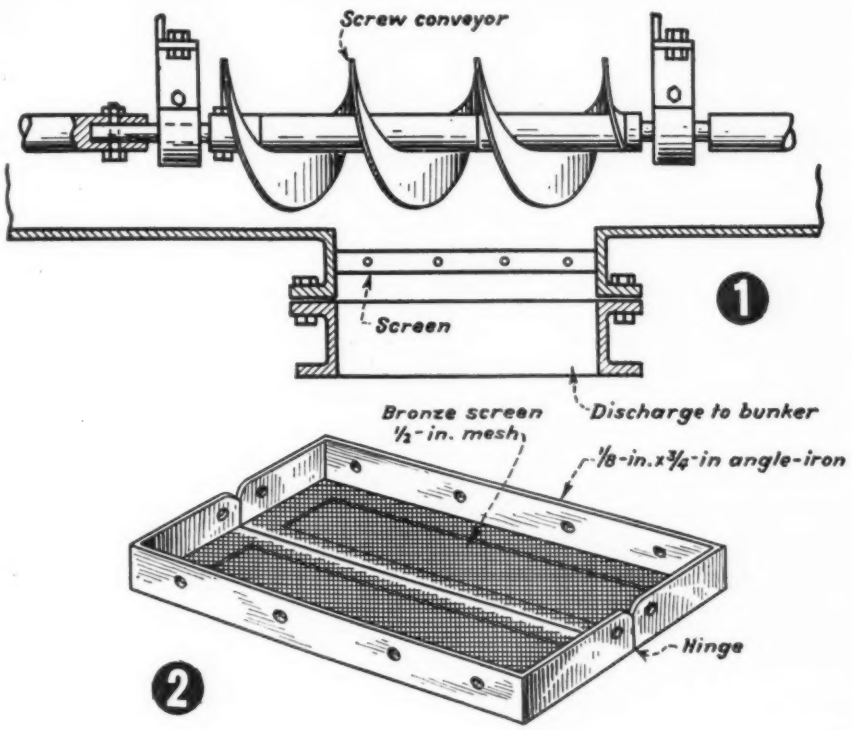
After that the inspectors kept an eye

on the ammeter and if one showed an increase of more than 10% in the motor load, kiln alignment was corrected. This not only saved the motors from being overloaded; it also prevented large power losses because of operating the kilns out of line for long periods of time.

In another plant where adjustable-speed dc motors were used to drive wire-drawing pull blocks, the operators were overloading motors by taking too heavy draws or by operating the blocks at too high a speed. We installed an ammeter in each motor circuit where the operator could easily see it. A red mark on the meter scale showed the safe load on the motor. This permitted maximum production without danger of overloading the motor.

We have determined the speed for different reductions of the wire to keep within safe motor loading. When operating under any combinations of conditions that are safe and the power demand is higher than it should be, the operator knows something is wrong, such as the metal not being up to standard or not having been properly annealed. He can then correct the conditions. Thus, the ammeter is a guide to prevent overloading the motor and also to improve the product.

Chicago, Ill. J B MULLENS



SCREENS REDUCE FEEDER MAINTENANCE

ONE LARGE INDUSTRIAL PLANT, using a bin pulverized-coal system had difficulty in maintaining coal feeders because of bolts falling into them from the screw conveyor. Bolts in the conveyor bearing hangers and flight couplings eroded off and were carried into the bunkers and from there into the feeders. When this occurred the feeder rotor fingers would usually bend before the safety shearing pin failed and stopped the feeder. Generally this meant a complete overhaul of the feeder. This trouble continued for many years with at least one feeder requiring an overhaul every four or five months.

To correct this trouble we installed a ½-in.-mesh screen in an outlet from the screw conveyor, Fig. 1, to catch the bolts before they could cause damage. The screen, Fig. 2, is hinged in the middle so that it can be worked under the conveyor screw and bolted in place without removing a section of the conveyor. An inspection hole with plate cover was placed in the conveyor casing just above the screen so that it could be inspected each month for wear, stoppage and bolts which may have lodged there.

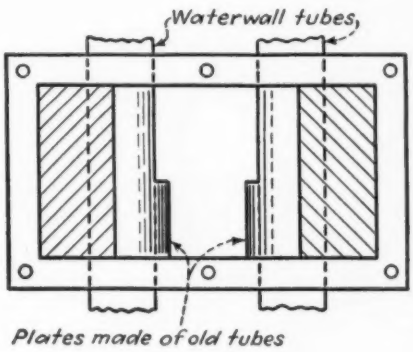
The screen has been in operation for several months and has passed about 10,000 tons of pulverized coals. Each month when the screen is inspected it is clear and shows no apparent wear. Since the screen does not plug with coal and operates satisfactorily we believe it is the answer to our problem.

Staunton, Va. B G SWITZER

Protects Waterwall Tubes At Lancing Doors

LANCING OF SLAG from the front wall and burners of our pulverized-fuel furnaces, during several years, caused considerable wear on the waterwall tubes adjacent to the lancing doors opposite the fuel burners. To prevent further wear, we cut sections of old tubes, which we welded over the waterwall tubes at the doors. As indicated in the diagram, these protecting sections at their base covered about one half the tube diameter, where the slag bars caused wear, and about ⅜ of the tube diameter at the upper part to permit inserting the torches for lighting the burners.

When welding, take care to use a lightweight rod and a low current to prevent the weld from penetrating the waterwall tube. A ⅛-in. welding rod with a 100-amp current was satisfactory. A light weld is all that is required because its only purpose is to hold the wearing plates in place against the tubes. Thus the boiler operator can do practically nothing to knock them loose. The protecting plates prevent wear and careless punching of tubes when the boiler operators place their slag bars through the lancing-door openings.



Staunton, Va. B G SWITZER

Powdered Asbestos To Extinguish Fires

MANY MATERIALS are used to extinguish oil fires, but we have found that old heat insulation from boilers, crushed to a powder, is superior to sand. It is light, not abrasive, a good fire extinguisher and not affected by fairly high temperatures. It forms a good blanket to keep air away from a small fire and is much easier cleaned up than sand and much less abrasive.

Woodford Green, England W E WARNER

READERS' PROBLEMS

Questions From Our Readers

SUITABLE ANSWERS from readers will be paid for if space is available for publication. Answers that are accompanied by rough drawings or photographs will command additional pay.

Question 1

Will This Hookup Be Satisfactory?

WE ARE PREPARING to install a 10x16-in. single-cylinder double-acting ammonia compressor which carries intake and discharge manifolds connected to both ends of the cylinder. The installation engineer is going to remove the manifolds and pipe up one end of the machine for single-acting operation.

I cannot understand why he should want to make a single-acting machine out of a double-acting one. Won't this increase our power cost considerably?

I suggested if it must operate single-acting that the manifold be left in place and fitted with shutoff valves so that we can make either end the working end. Naturally, this arrangement must include suitable relief valves to prevent high internal pressure in the end not connected to the system. The erector says this is too dangerous to consider. Will POWER readers help me with this problem?—*TMM*

Question 2

Needs Help on Selecting Valves

WE NEED A REGULATING VALVE to regulate steam flow to a closed water heater and another to maintain an accurate liquid level in a process tank. The steam-regulating valve will operate at frequent on-and-off periods. On the other hand, the liquid level valve must operate at different points within its range to regulate liquid input according to varying amounts of outflow.

I have been studying flow-travel curves of V-port, throttle-plug and ratio-plug regulating valves without coming to any conclusion as to which of the three is best suited to my purpose. Will POWER readers give me information on the special merits of these valves for different flow requirements?—*BVN*

Answers to July Question 1

Is This Compressor At Fault?

WE HAVE *a duplex 2-stage cross-compound steam-driven 100-psi air compressor operating on 150-psi steam. Air intake is inside the building where the temperature varies between 80 and 100 F throughout the year. During certain hours of the day we are unable to maintain full air pressure.*

It would require three 8-in. elbows and 17 ft of 8-in. pipe to run the intake outside the building. Before going to this expense we would like to know whether the resulting increase in the machine's capacity would warrant this addition.

The compressed air system contains no meters so we are unable to determine whether the compressor output is up to rated capacity. How can we determine whether the machine is operating below capacity and what tests to run to find the cause?—RN

Outside Air Increases Capacity

AN APPROXIMATION of the power saved by drawing air from outside the building can be worked out by Charles' Law. Assume an average building temperature of 90 F, with compressed air in the building lines also at 90 F. Assume an outside air temperature of 50 F. On a free air basis:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}\text{; then } V_1 = 0.927 \text{ cu ft}$$

For every cu ft of free air delivered the compressor draws only 0.927 cu ft, giving a direct saving of about 7%. This results in a proportional increase in air-compressor capacity. Expense of installing the intake duct would certainly be warranted in this particular case.

Regarding air-pressure loss during certain hours, check the water supply to intercooler and aftercooler. Decrease in supply means increase in air temperature and increase in power required to compress the same amount of air if intercooler lacks sufficient water.

To determine whether the machine operates below capacity, use testing equipment and procedure in the ASME Test Code. For less elaborate testing install a properly calibrated orifice. If only relative capacities and not absolute volumes are needed, interpretations can be made by comparing pressure drops in the pipe. (Example: POWER *Data Sheet*, August 1943, or Dec, 1943, POWER, page 818-820.

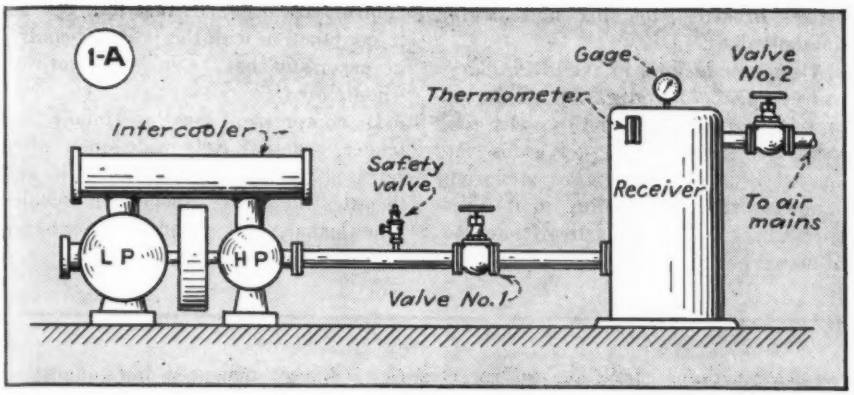
Rahway, N. J. B J DI SANTO

Depends on Climatic Conditions

COST OF INSTALLING a fresh air intake would probably be justified, dependent upon local climatic conditions. During part of the year outside temperature is likely to be at least equal to indoor temperature and at such times no increase in machine output would result. If located where the average outdoor temperature is 25 or 30 F below the average indoor temperature, cost of extending the intake pipe would be justified since machine output will be increased about 1% for each 5 F the intake-air temperature decreases.

Principal object gained by installing an outdoor intake is more efficient operation. Increased output does not deserve too much emphasis because often there is no increase. For each cubic foot of air delivered at the indoor temperature somewhat less than a cubic foot must be taken in, if intake temperature is below the temperature at which the compressed air is actually used. This means that for each cubic foot delivered, the power becomes less as the air intake temperature decreases. Savings made this way would probably average about 5 to 8% where the climate compares with New York State's.

There are other, lesser advantages in favor of outdoor intake. The cooler the intake air, the easier it is to maintain the compressor cylinders at the proper temperature, and less cooling water is required. Often the outdoor air is cleaner. Usually it is desirable to bring



as much fresh air into a room as possible so the amount brought in by a large compressor is worth considering.

If air intake is extended outdoors, observe these precautions: As the pipe is extended, effect of pulsations may be more pronounced, particularly if a filter is used. I suggest using only round pipe with wall thickness not less than ⅛ in. Intake opening should be preferably on the north side of the building or 5 ft above the roof.

Accurate determination of the output or efficiency of a reciprocating compressor, which is described in the ASME Test Code, is difficult to measure. But if a large receiver is available, an approximate test can be made by measuring the time required to pump it to a given pressure, sketch 1-A.

1. Reduce receiver pressure to zero.
2. Install thermometer in or on receiver.
3. Unload compressor and bring up to constant speed.
4. Load the compressor. Calculate air delivered by compressor with this formula:

$$D = V \frac{(P_2 - P_1)}{A\ T}$$

D = Actual delivery in cfm
T = Time in minutes elapsed between reading P_1 and P_2
A = Atmospheric pressure in psi
V = Volume of receiver and piping in cu ft
P_2 = Final pressure in receiver (corrected for intake temperature)
P_1 = Pressure in receiver at start of test. (This need not be zero)

Take care that compressor operates at constant speed during timing period and it probably will be necessary to correct reading P_2 to room temperature conditions as follows:

$$P_2 = P_r \frac{T_1}{T_2}$$

P_2 = Corrected value to use in computing D in preceding formula (psi)
P_r = Pressure in receiver at conclusion of timing period
T_1 = Intake temperature (deg F) plus 460
T_2 = Receiver temperature (deg F) plus 460

If the compressor does not indicate approximate rated output in this test, check these points carefully: (1) air valves—both intake and discharge (2) compressor speed (3) intercooler temperature (4) entire air system for leaks and excessive pressure drops due to inadequate piping.

Elmira, N. Y. M H ELKIN

Check the Valves For Correct Lift

THERE IS SCARCELY an installation where it does not pay to draw the air from outdoors because the average outside temperature is considerably below that in buildings. It would certainly pay RN to pipe the air intake outside when this increases compressor capacity from 5 to 10%.

To insure the compressor operating at maximum capacity, check suction and discharge valves to determine if they seat properly and have the correct lift. Air pistons and piston rings should be inspected for wear, and pistons should have correct clearance.

Bronx, N. Y. ANTHONY GREER

Increase Intake Pipe Diameter

IF FACTORS other than inlet temperature remain constant, installing the suction pipe outdoors increases air delivered in proportion to the ratio T_2/T_1, where T_2 is the inside and T_1 the outdoor temperature absolute, (F+460). There are few installations where it does not pay to take the suction from outdoors. If the outdoor air temperature averages 20 F less than indoors (90 F) the saving is 3.77%, or for every 100 cu ft of free air actually delivered to the tools only 96.4 cu ft enters the compressor.

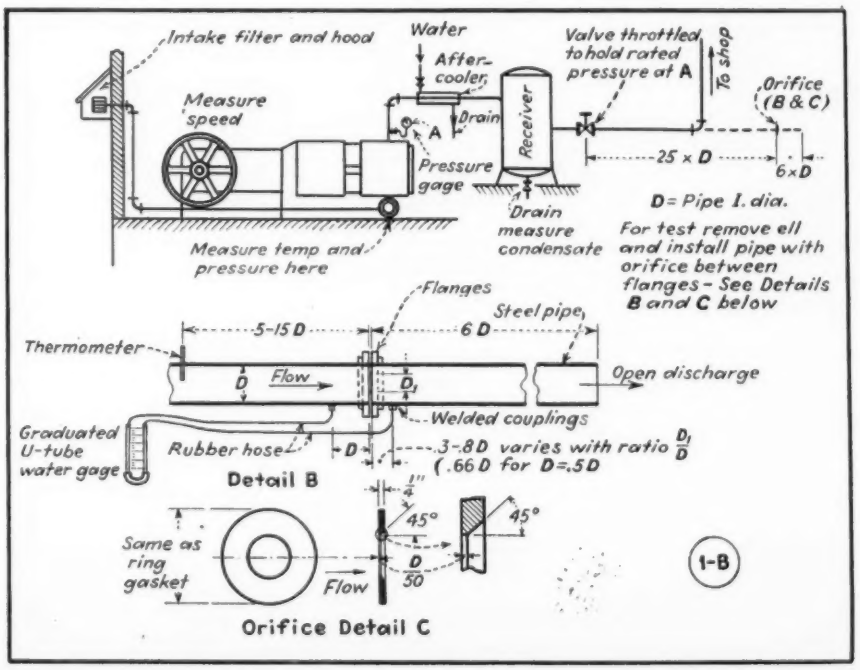
The only accurate method of checking compressor output is by nozzle or orifice test following the ASME Power Test Code. Complete details of flow coefficients, factors, and methods of calculation are given in "Flow Measurement 1940" issued by the ASME as Chapter 4 of Part 5 of *Information on Instruments and Apparatus.*

To obtain reliable results, follow test nethod closely. Sketch 1-B illustrates the approved setup. If the unit cannot be taken out of service for test, indicator cards of all cylinders may help in solving the problem.

Examine cylinders, pistons and valves of both air and steam ends and repair at intervals that will keep their condition satisfactory.

Check system piping for leakage by pumping receiver to full pressure, noting pressure-fall rate. Also examine air tools for mechanical condition and repair or replace to avoid air waste.

Saint John, N. B. C G CLARK



More Readers' Problems on next page

Take Indicator Cards

IF THE STEAM ENGINE is a duplex twin cylinder or a cross-compound unit, controlled by a combined inertia and throttling governor, RN should check the speed. He can also take cards of the l-p and h-p cylinders to check compression, discharge, and the re-expansion line in air cylinders. Thus, he checks leaky valves, broken piston rings and sticking intake valves.

Of course leaking intake or discharge valves can be found easily when compressor is running by noting valve temperature. Leaky valves get excessively hot while a good valve runs at normal temperature corresponding to its pressure. Check free air capacity of machine. If manual or automatic clearance-pocket controls are used, see that they operate in conjunction with the pressure-control governor and that the valves do not leak when closed.

If compressor uses an intake unloader, see that it is wide open when released because it sometimes sticks and throttles the intake. Inspect intercooler tube leakage by examining discharge

(*Continued on page* 162)

Answers to July Question 2

How Is This Motor Wired?

WE HAVE JUST PURCHASED *a used tumbler complete with a 220-v 3-phase 60-cycle induction motor, double contactor and rotary switch for our laundry. The tumbler is supposed to reverse its direction of rotation every 15 sec. We did not receive a timing device or wiring diagram and I would like to know how to wire this equipment. Can the rotary switch be gear driven from a small motor? How must I wire the contactor control?—FR*

Suggests Buying a Timer

FR ASKS if it is possible to connect the rotary switch to a separate motor drive. This all depends on the switch. If it is the continuous rotating type, with two separate cam-operated contacts arranged to close alternately with intermediate open positions between changes, the idea is feasible. Motor speed and connecting gearing would have to be selected to suit the operating time.

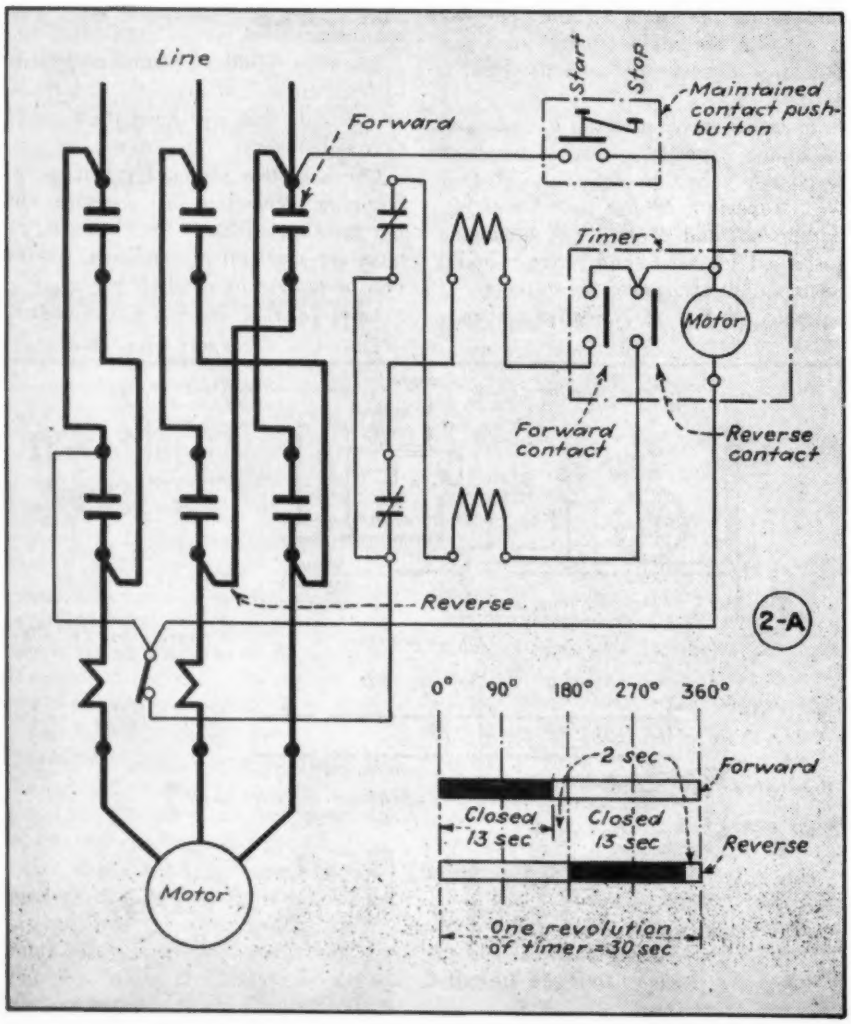
However, if the rotary switch is a cam or traveling limit switch, with definite rotational limits, do not try to use it.

Get a timing device specifically built for laundry machines. Such a timer costs about $30 and requires far less critical material and labor than using the present rotary switch.

It is essential that the rotary switch, or timer, be arranged to disconnect the motor for a period of two or three seconds at the end of each directional run before restarting in the opposite direction. This saves mechanical wear and tear on the laundry machine, which might otherwise be caused by practically instantaneous reversals. The electrical system also benefits since fuses do not blow or lights flicker.

The wiring diagram, sketch 2-A, is applicable to either a timer or to the motor-driven rotary switch.

Detroit, Mich. E HECHT



Use Washing Machine Parts

A FRACTIONAL HORSEPOWER motor drive to operate the rotating switch is probably the cheapest solution.

If difficulty is experienced in obtaining a suitable gearbox, one might be obtained from an old domestic washing machine. Because the final speed would still be too high, obtain further reduction by a belt and pulley arrangement between gearbox and rotating switch. Exact wiring depends upon the make of switch and contactor.

Hamilton, Ont. J A CAULDEN

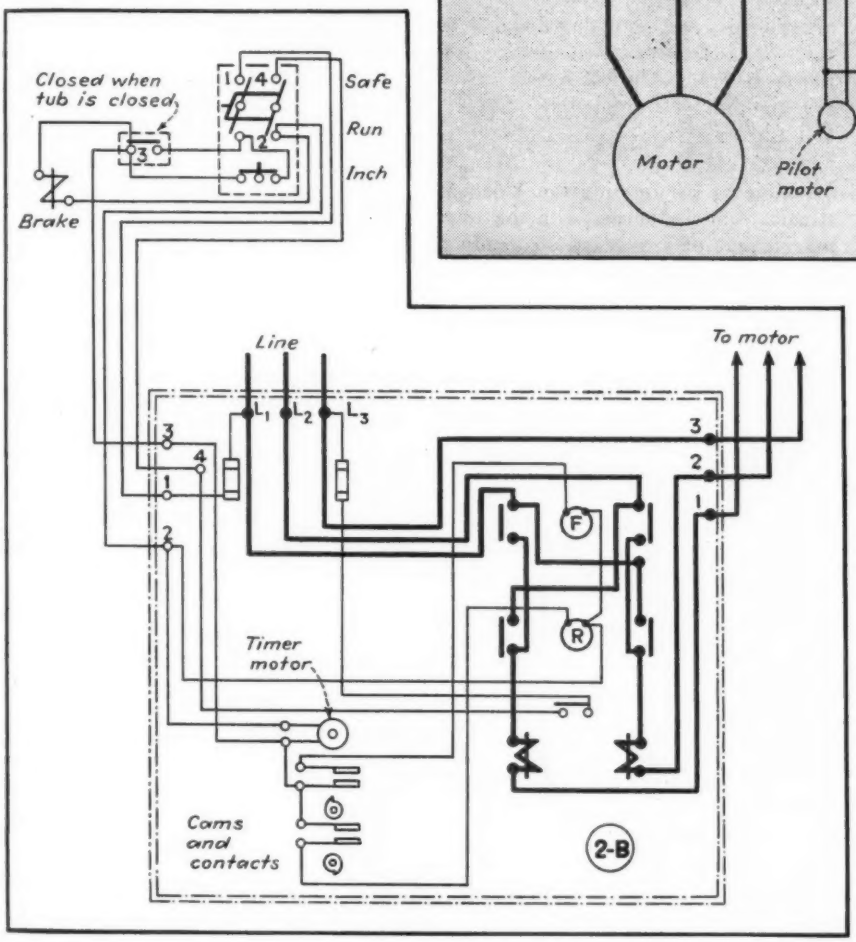
Increase Running Time

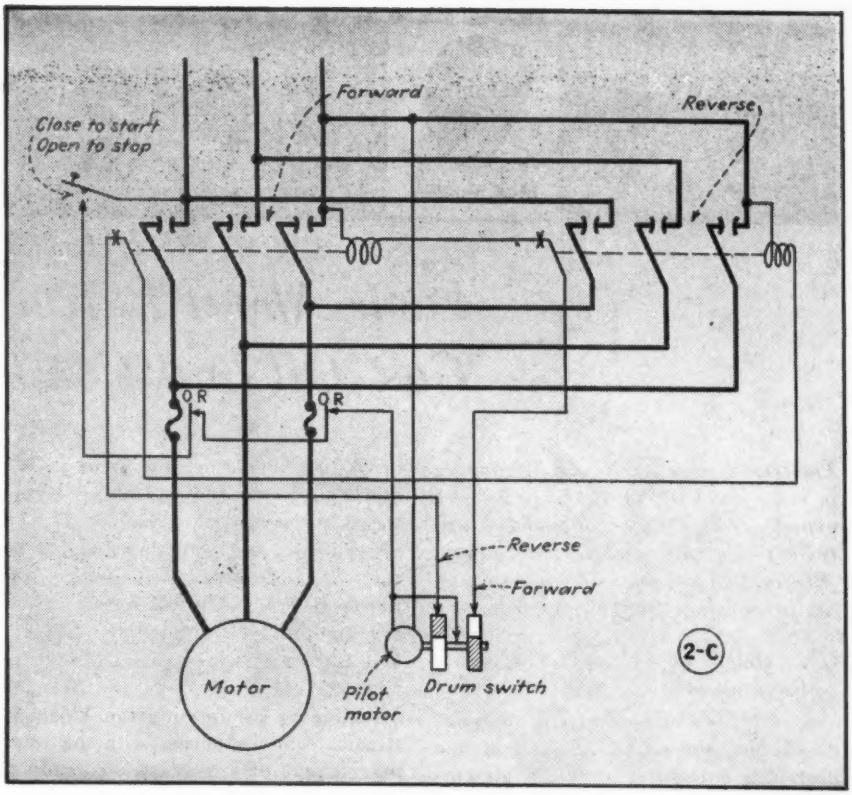
I DO NOT KNOW where FR got his 15-sec running schedule, but if he tries to use it, I believe he will encounter difficulties. The machine will operate much better with a running time of approximately 30

sec each way. To cut down heavy starting current, make the off period at least 5 sec. With an off period less than 5 sec, the tumbler has considerable roll speed which the motor must stop before reverse direction starts. Some momentum remains even with five seconds, a part of which must be considered normal.

Another tip: Watch overcurrent trips. The small wire holding the plunger rod to the dashpot cup often quickly wears in half if a soft wire is used. Sometimes it is difficult to find the trouble. It will trip, then drop back and catch a wire end. When checking, jiggle the plunger and give it a little pull. A good steel wire slows up this wear.

Shiprock, N. M. J F MAHER





Tumbler Needs A Brake

SKETCH 2-B SHOWS how to wire a tumbler. FR does not mention a brake on the machine but undoubtedly there is one. Without a brake, constant reversal of the motor would soon heat it to a point where it would burn out. The rotary switch may be driven from a small motor, probably a fan motor.

Carlsbad, N. M. E A ROBERTS

Suggests Electric Clock Motor

THE ROTARY SWITCH FR purchased is obsolete. He should get an electric clock motor fitted with make-and-break contacts. (Motors made by sign-flasher manufacturers.)

Contacts can be set for any timing action to control the forward-and-reverse contactor coils through suitable relays.

Bronx, N. Y. GEORGE GRIFFEL

Contactors Must Be Interlocked

KEEP IN MIND that a 3-phase motor can be reversed by interchanging any two terminals. The double contactor is in fact two contactors. They are mechanically interlocked to prevent both closing at the same time. Also, they probably have electrical control contacts that close when the contactor is open, so that they may be electrically interlocked to prevent simultaneous closure of both. If the contactors are individual and separate units, they must be fitted with mechanical or electrical interlocks (preferably both).

FR does not describe the rotary switch, but it is assumed that it is 2-pole, energizing one contact while the other is de-energized, and vice versa. On this assumption, sketch 2-C shows one method of connecting a laundry tumbler. The rotary or drum switch can be driven by a small pilot motor, geared so that the switch makes one revolution every 30 sec. During half of the revolution, pilot wire marked *Reverse* is energized, while during the other half, pilot wire marked *Forward* is energized.

If the rotary switch has only one pole, it can, nevertheless, be used by wiring the pilot wire marked *Forward* through that one pole, and connecting the wire marked *Reverse* directly to the right-hand overload relay marked *OR*.

Kalamazoo, Mich. E E NORMAN

18—*Facts About Pulverized Fuel, Gas, Oil and Combustion*

Eighteenth in a series that is running in every number of POWER. *From long experience as a professional and practical engineer, Alex Higgins, of Calgary, Alberta, Canada, asks and answers questions regarding power equipment.*

Q 1—How is pulverized fuel burned in boiler furnaces?

A—In burning pulverized or powdered fuel, the coal is ground to fine dust in a pulverizing mill. An air current blows this dust into the furnace, where it burns almost like a gas. Fig. 1 shows one type of pulverized fuel burner. The fuel-laden air current enters the outer chamber of the burner, which is shaped to give the current a circular motion. This tends to throw the coal outward, so vanes are placed around the inner circumference to divert the stream towards the center and keep the coal-and-air mixture evenly distributed across the entire area of the pipe. The coal spreader at the burner tip breaks up the mixture into alternate lean and rich layers and causes the stream to assume a conical form.

Secondary air, supplied by a separate fan, is admitted around the tip of the fuel burner. The volume of secondary air can be regulated by dampers, and adjustable vanes give it a whirling motion before it enters the furnace. Mingling of the rotating fuel-laden air stream from the burner with the rotating current of secondary air tends to insure thorough mixing of the air and fuel and complete combustion.

The fire is started by inserting an oil or gas torch through the tube in the front of the burner and then turning on the primary air and coal supply. Or a torch made from waste dipped in oil may be inserted through an observation opening. The torch should be in a position to ignite the fuel at the instant it is admitted to the furnace. If for any reason the fuel does not ignite, the torch should be withdrawn immediately and the setting allowed to clear before again trying to light up.

The secondary air supply is adjusted after the fire is lit. The shape or angularity of the burning flare can be changed by advancing or withdrawing the coal spreader by means of the tube in the center of the burner. Firing can be switched over to oil by inserting an oil burner in the center pipe.

Q 2—Sketch an arrangement for burning pulverized fuel in a boiler furnace.

A—Fig. 2 is a diagram of a pulverized-coal-burning layout. Coal from a storage bunker feeds by gravity to a pulverizing mill. A fan draws the fine coal dust from the pulverizer and delivers it to the burners. Another fan supplies the secondary air needed for complete combustion.

Q 3—Explain the construction and operation of low- and high-pressure gas burners.

A—The important thing in all gas-

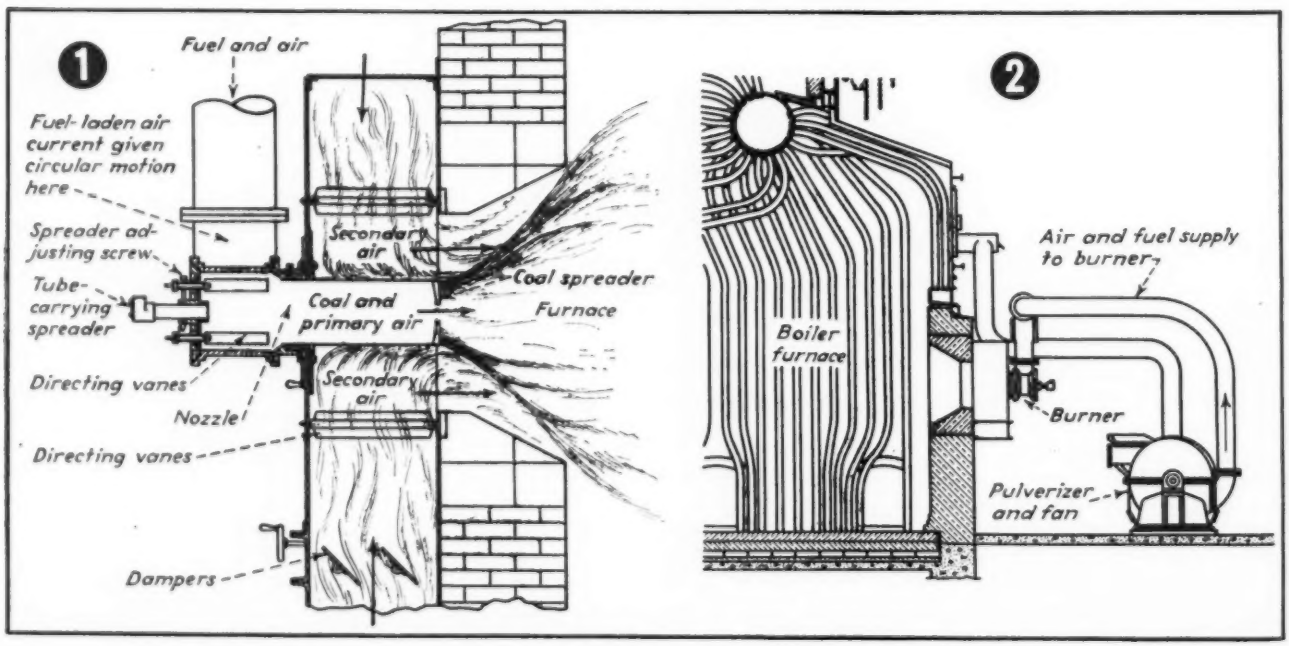


Fig. 1—Pulverized coal burner. Fig. 2—Pulverized coal burner installed in watertube boiler setting

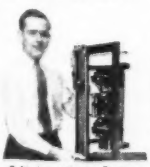
TO SAVE TIME, MANPOWER, SPACE, *TODAY and TOMORROW*...USE UNITROL

The Filing Cabinet Idea applied to motor control

1. Skeleton Starter

Unitrol is built up in much the same way as the familiar filing cabinet system.

The skeleton starter or switch (see photo No. 1 at left) is fitted into a frame with a door in front (see photo No. 2 below).

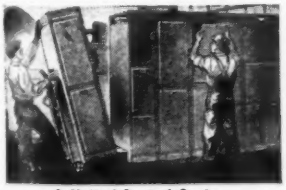


2. Unitrol Door Frame

This Unitrol "unit" is fitted into a section (see photo No. 3) and sections are placed side by side, as many as you want as in sketch at bottom.

3. Unitrol Section

Like your filing cabinet system, the contents of each "drawer" are easily changed or placed in other "drawers". Sections can be rearranged, moved elsewhere, or new ones added. Unitrol is the flexible, versatile system of housing motor control for all time, ready at any time to meet all needs. You should investigate it today.



4. Unitrol Control Center

You can begin any time to put in UNITROL, the *better* way to house, install and systematize motor control. If you are buying control for new machines, ask for it in Unitrol. Then you won't have to spend time and manpower on wall or floor preparation. Unitrol can be placed anywhere in the plant ready for work the moment electrical connections are made.

If you are moving equipment around because of a production changeover, make it an opportunity to house the control in Unitrol. Then your inspection and service men can accomplish more because the control will be grouped in a compact Unitrol "center", convenient of access, easy to service, hard to overlook. Tremendous space savings result because Unitrol can accommodate 2 or 3 times as much control in equivalent floor space.

Unitrol is the modern method of housing control, ready made, ready for use, yet built to individual need from unitized, sectionalized members that you can add to, subtract from or rearrange with complete freedom. Many industrials, wanting to be *first* with the *right* answer for today *and* tomorrow, are swinging to Unitrol. For the facts behind the swing, write today for the big free Unitrol book. CUTLER-HAMMER, Inc., 1358 St. Paul Ave., Milwaukee 1, Wis. Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ont.

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Engineering Excellence Finds its Greatest Reward in the Respect and Confidence of those it Serves

Q&A FOR POWER ENGINEERS

(Continued from page 118)

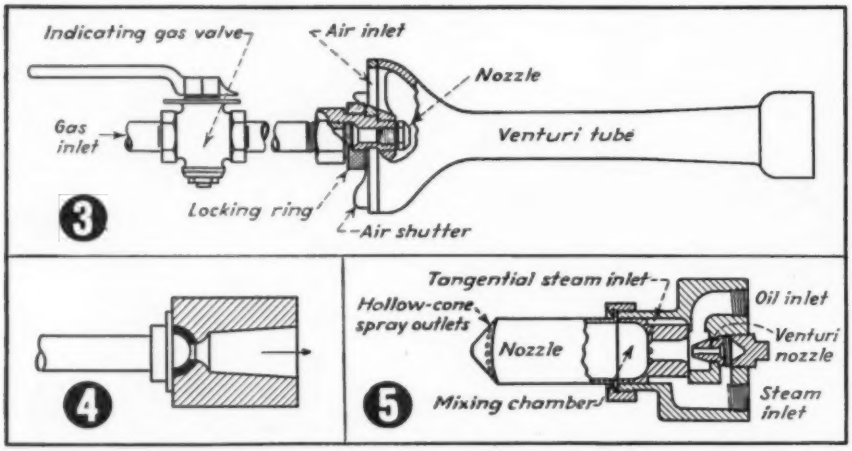

Fig. 3—Mixer for high-pressure gas burner. Fig. 4—High-pressure burner tip. Fig. 5—Tip of a burner that atomizes the oil by steam under pressure

burning devices is a correct air-and-gas mixture at the burner tip. Low-pressure burners, using gas at pressure less than 2 psi, are usually of the multi-jet type, in which gas from a manifold is supplied to a number of small single jets, or circular rows of small jets, centered in, or discharging around, the inner circumference of circular air openings in a block of some heat-resisting material. The whole is incased in a rectangular cast-iron box, built into the boiler setting and having louver doors in front to regulate the air supply. Draft may be natural, induced or forced.

Fig. 3 shows a high-pressure gas mixer in which the energy of the gas jet draws air into the mixing chamber and delivers a correctly proportioned mixture to the burner. When the regulating valve is opened, gas flows through a small nozzle into a Venturi tube (a tube with a contracted section). Entrainment of air with high-velocity gas in the narrow Venturi section draws air in through large openings in the end. The gas-air mixture is piped to a burner. The gas-burner tip may be in a variety of forms. The one in Fig. 4 is called a sealed-in tip because the proper gas-air mixture is piped to the burner, and no additional air is drawn in around the burner tip. Size of the air openings in the Venturi tube end is increased or decreased by turning a revolving shutter, which can be locked in any desired position.

Q 4—Sketch some type of steam atomizing burner and explain its operation.

A—Fig. 5 shows the tip of a steam atomizing oil burner with part cut away to show the internal construction. Fig. 6 is a sectional view of the complete burner installed in a boiler setting.

The fuel oil entering the burner tip meets a high-velocity steam jet which forces it past a row of smaller steam jets into a mixing chamber. These small steam jets give the oil a whirling motion that tends to break it up into very fine particles through the action of centrifugal force. The atomized oil is then blown through small holes in the tip of the burner in the form of a cone-shaped spray. Air for combustion, controlled by adjustable louvers, passes through the burner. The burner and oil line can be blown clean with steam when the burner is not in use.

Q 5—Sketch and describe a burner in which the oil is atomized by pressure alone.

A—This type is usually called a "mechanical" burner to distinguish it from the steam atomizing burner. The mechanical burner breaks up the oil into very fine particles by forcing it under high pressure through a number of very small passages in the tip. Oil pressures run from 30 to 300 psi, depending on the burner, and the oil must be heated to temperatures ranging from 100 to 300 F so that it will flow freely. Air for combustion is usually admitted through the burner casing, and the burners are blown out with compressed air when not in use, to prevent the oil hardening and clogging the passages.

A mechanical oil burner top is shown in section, Fig. 7. In this particular burner, oil is forced through tangential slots in the nozzle against a sprayer plate, which causes the oil spray to issue from the burner in the form of a hollow cone.

Fig. 8 shows the complete burner installation. Air for combustion enters through adjustable louvers, which give it a rotary motion. This motion is further accentuated by the diffuser, or impeller plate, at the tip of the burner. The diffuser plate also splits up the air

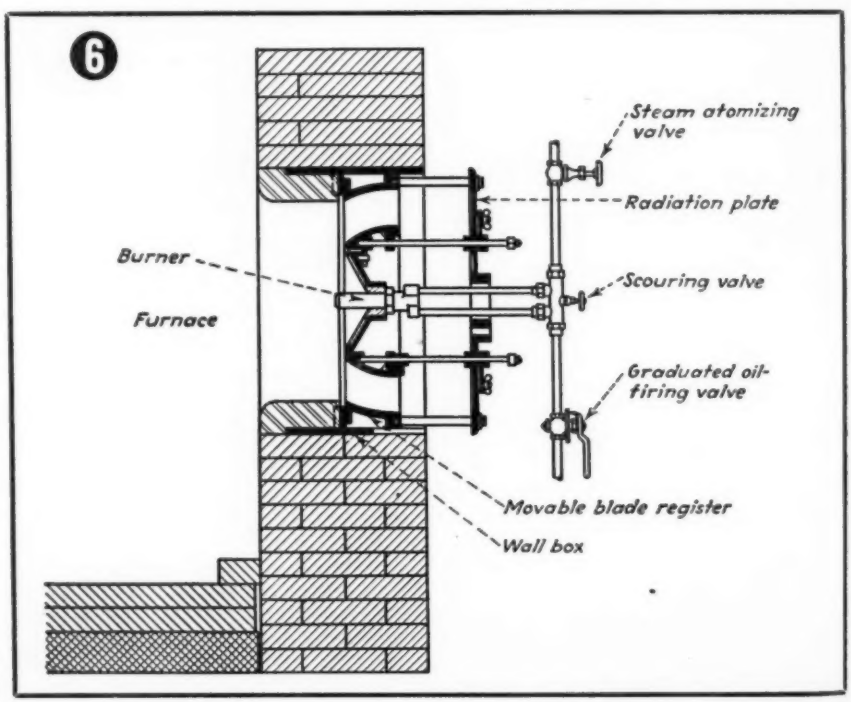

Fig. 6—Steam-atomizing oil burner is convenient, but involves steam cost

YARWAY TRAPS "Go to Penn"

In the new, highly modern Harrison Laboratory Building of the University of Pennsylvania, 30 little Yarway Impulse Steam Traps handle the condensate draining job for the entire building's steam facilities—heating mains, hot water service heater coils and live steam lines to laboratory benches.

The selection of Yarways for this newest Penn building, no doubt, was influenced by the satisfactory service of more than 100 Impulse Traps in use throughout the University.

The *small size* of the Yarway Impulse Trap—hardly larger than a pipe fitting—its *straight-through piping* connections, and its *light weight—requiring no special support*—make possible the trim, compact, well-engineered piping arrangement illustrated above.

But even more important—its *continuous discharge on heavy condensate loads* brings cold equipment up to temperature more quickly; its *intermittent discharge on light loads* gives greater sustained heating efficiency.

Have you investigated this trap about which more and more users say: "When we need additional traps, they will be Yarways." (*More than 300,000 have been purchased.*)

You may be surprised to learn that it will *cost no more* to replace with Yarways *than to repair old, ordinary traps.* It's often the case, so why not get Yarway performance for your money?

Ask for Bulletin T-1738, or see your local Mill Supply Dealer.

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YARWAY IMPULSE STEAM TRAP

Q&A FOR POWER ENGINEERS

(*Continued from page* 120)

stream so that air and oil spray mix thoroughly before burning. Burners of the types in Fig. 6 and 8 are also made to burn either oil or gas. There are even triple-service burners that burn oil, gas or pulverized fuel.

Q 6—Sketch and describe a burner that burns oil or gas as required.

A—A combination oil-and-gas burner is shown in Fig. 9. The oil-burning part is of the mechanical type, somewhat like that of Fig. 8. The gas burner is a ring with many small jets on the inside. The air supply is controlled by opening or closing the movable blade registers.

Q 7—Sketch a method of installing oil or gas burners in a boiler furnace.

A—As the burning characteristics of oil and gas are much alike, the same method of installation does for both, and very often combination burners are used that burn either oil or gas. Fig. 10 shows oil burners under a watertube boiler.

Loose firebrick checker walls and firebrick baffle walls are sometimes placed in gas- or oil-fired furnaces to assist in the mixing and ignition of the gas-air mixture. When using these, take great care not to construct them so that heat is concentrated on some particular part of the boiler, thus burning or bagging tubes or plates.

Q 8—What precautions should you observe when firing boiler with gas?

A—(a) See that all gas valves are tight and that there are no leaks in pipes or fittings.

(b) Perforate all dampers to insure sufficient draft, even when dampers are closed, to carry off any gas that may enter the furnace through a leaky valve or from the accidental opening of a gas valve.

(c) Before lighting burners, make sure gas valves are tightly closed, dampers open, and no gas already in the furnace. Use a proper torch for lighting up.

(d) If burners blow out from any cause, allow a long enough interval to clear the furnace of gas before lighting up again. Do not attempt to light burners from hot brickwork; use a torch. Many serious accidents have occurred from neglecting these precautions.

(e) When starting to fire up, warm furnace slowly so as not to damage the setting or the boiler through excessive expansion of some parts while others remain cold.

(f) When forced or induced draft is used, start the draft fan and let it run for a short time before lighting up, to sweep away any possible accumulation of gas in the furnace. Keep the fan running for some time after shutting off the gas supply, to make sure that the furnace is clear of unburned gas, so there will be no danger of explosion.

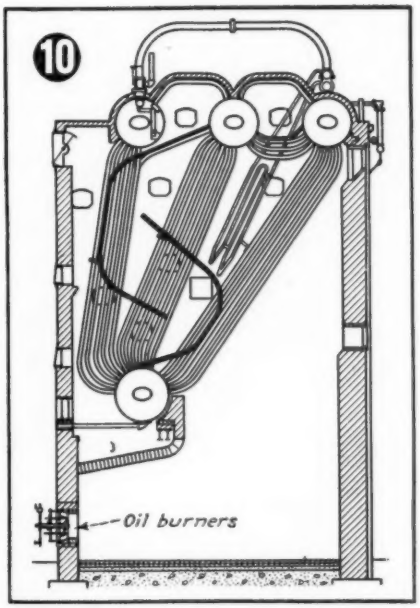

Fig. 10—Typical oil burners installed in a watertube-boiler setting

Q 9—What precautions should you observe when firing boiler with oil?

A—(a) See that oil pressure and temperature are correct before lighting up and, when steam atomizing burners are used, that there is sufficient steam pressure. Open dampers.

(b) If the oil spray does not ignite at once, or if the burners blow out from any cause, allow enough time to elapse

(*Continued on page* 170)

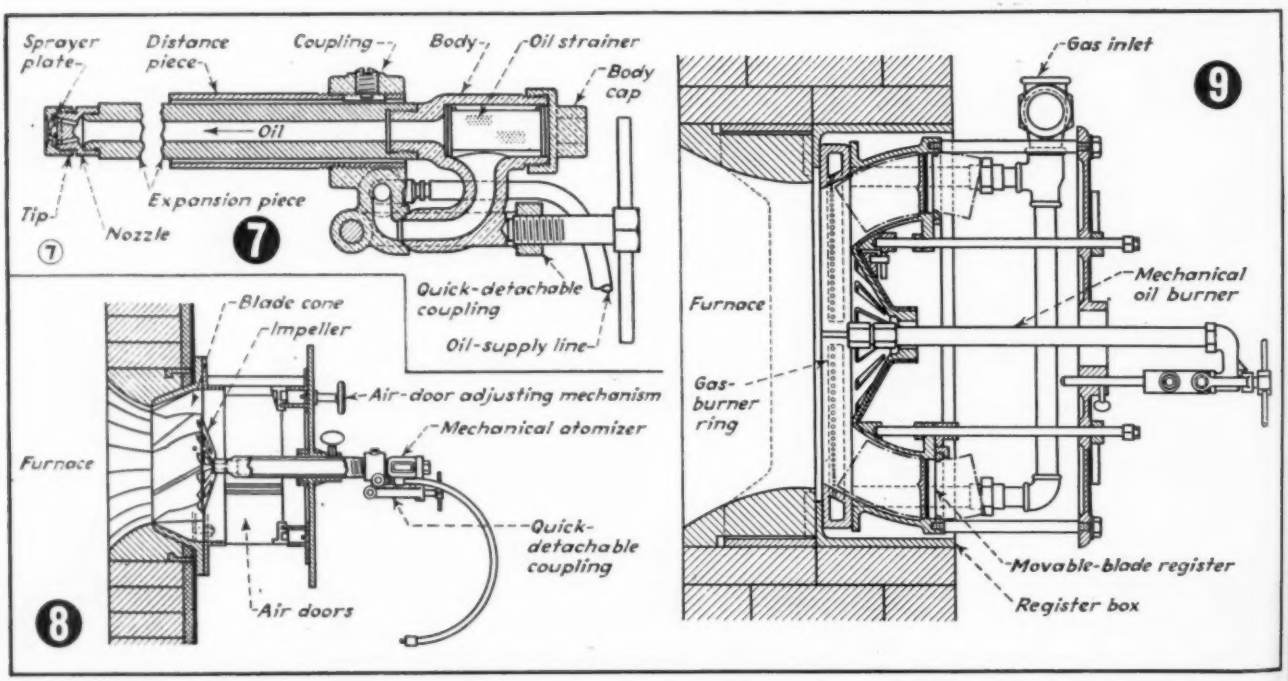

Fig. 7—Tip of mechanical oil burner. Fig. 8—Complete installation, mechanical burner. Fig. 9—Gas-oil burner

VALVES GO 4 YEARS *Without Losing Face*

SUNISO OIL

Clears up compressor carbon . . . stops forced shutdowns

The last four years have been hard ones on machinery . . . heavier loads, faster speeds, longer hours of operation, scarcity of replacement parts. But here's a case where four ammonia compressors in a large ice and cold storage plant have had smooth sailing despite wartime hardships. One reason — they adopted Suniso Oil four years ago.

Trouble with carbon and sludge was experienced before that time. Every year they had to make forced shutdowns for cleaning and adjustments during the busiest season. Also their lubrication bill was high because, due to congealing, it was difficult to reclaim oil that carried over into the cooling system.

Since changing to Suniso they have had trouble-free service. In fact, in four years not one valve has been replaced . . . or even refaced! There have been no forced shutdowns . . . no mechanical difficulties . . . and the annual check-up always finds the compressors free of carbon and sludge. With Suniso, the oil which is carried over is easily reclaimed . . . thus lowering costs.

This performance is typical of the whole line of Sun quality lubricants. No matter what mechanical equipment you have, there's a Sun lubricant to increase its efficiency. As an added service Sun offers you without cost or obligation the new "Save and Serve" Plan to help you save time . . . equipment . . . labor. Write for folder describing it!

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SUN INDUSTRIAL PRODUCTS

HELPING INDUSTRY HELP AMERICA

REFRIGERATION NOTEBOOK — 15

Simple Remedies Often Correct Major Troubles

By TERRY MITCHELL, M E, *Frick Company*

HERE ARE VALUABLE trouble-shooting hints taken from the experiences of erectors and plant operators.

(1) A packing plant had an old steam-driven compressor which began to lose its cooling capacity. Conditions got slowly worse until a trouble-shooter found one of the manifold bypass valves had been carelessly left slightly open.

(2) Old-style enclosed compressors frequently had the cooling-water outlet at the side of the jacket (which covered the cylinder heads) instead of at the top. Unless the petcock provided is opened regularly, air collects in the upper part of the jacket and prevents proper cooling of the heads. The remedy is to run a ¼-in. drain line from the top outlet; or tap the cover with a hole large enough for the main drain pipe.

Check Purger Connection

(3) A plant having horizontal shell-and-tube condensers used a purger, but the system continued to fill with air. The trouble-shooter noticed that the purger was connected to the condenser top. He ran a line from it to the receiver top, where the foul gas was really collecting. In former years it was customary to install condensers without connecting an equalizing line between their tops and the receiver gas space, but this is now standard practice.

(4) An ice plant had two horizontal shell-and-tube condensers of ample size, mounted one above the other. The top shell refused to work; hence head pressure went out of sight. Investigation showed that one of the ammonia drain lines had become bent slightly upward, causing the top shell to bottle-up with liquid. It was also found that cinders and smoke from railway engines were fouling the cooling water and condenser tubes.

(5) An inexperienced man wished to mix calcium brine for an ice tank. He dumped the salt into one corner of the tank, and depended on the agitator to do the mixing. The salt hardened into a mass that had to be dug out. Always dissolve the salt in a separate vessel, adding proper chemicals to prevent corrosion, before emptying the solution into the large body of cooled tank water.

(6) An apple storage had a small old machine and a large new compressor. When the old machine alone was used, everything worked fine. But when the apples were harvested and the load switched to the big unit, the receiver promptly went dry. A check-up revealed that, during the summer, the drain line had been buried under a newly built road, forming a loop which became gas-bound, preventing liquid flow into the receiver. An equalizing line, run above the driveway, cured the trouble.

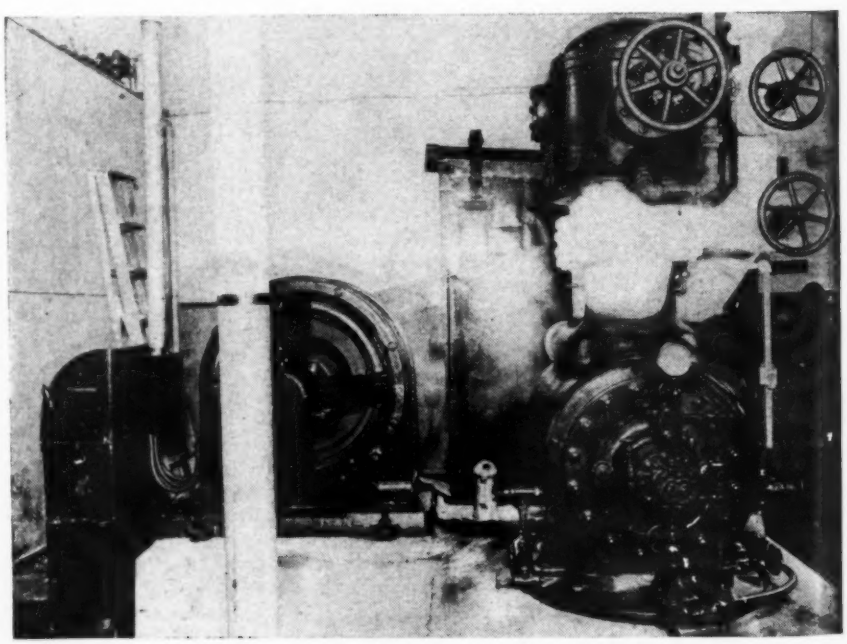
(7) A quick-freezing plant was carrying low temperatures with a booster compressor that discharged through a liquid-and-gas intercooler into the second-stage or high-pressure machine. Booster driving motor persistently overheated. No reason could be found until it was noticed that the shaft seal at times leaked considerable oil. As soon as the booster suction pressure reached a vacuum, leakage stopped, which made the engineer think the seal was then working all right.

Actually, the machine was drawing air in through the same opening that had been leaking oil; continued for hours, this accumulation of air filled the intercooler and shell condenser beyond the second-stage compressor. The air was hand purged occasionally but it gained on the engineer without his realizing it. After adjusting the shaft seal and installing a purger, the motor carried the load easily.

Leaks at Hidden Joints

(8) A dairy plant was troubled by ammonia leakage near a bank of double-pipe brine coolers that no one could locate. Sulphur fumes turned white when the flame was brought near the pipes. Flanged joints were tightened, but the ammonia smelled stronger all the time. It was finally discovered that a flange joint in the liquid line buried under the cement floor had sprung open because the bolts were only finger tight. Ammonia had soaked through the cement in all directions.

(9) An automatically controlled plant gave trouble due to varying head pressure. Upon dismantling the water-control valve a live minnow was found in one of the passages! Installing a strainer ahead of the valve solved this problem.



Trouble shooters must be able to solve all kinds of operating problems including the seemingly simple case of excessive frosting-back on this machine

Duke Says—
"...We agree with you Joe... corrosion in steam lines is plenty severe*"
Duke Cosner
National Aluminate Corporation
* Joe, a master mechanic in a large industrial plant says—"corrosion shows up very heavily in the steam lines... makes us inspect valves and pipe lines often... in some places valves and pipes won't last a year."...
Source: Survey conducted by a well-known power publication.

...but Nalco can prevent it!

Listen Joe, you don't have to have corrosion in your plant, because the Nalco System prevents corrosion, makes valves and pipes last longer, and what's more the Nalco System of Feedwater Treatment stops scale and carryover with its subsequent heat losses, damage and shutdowns.

Nalco engineers and chemists, with the world's finest and most modern water treatment laboratories at their disposal, approach the subject of water treatment from the standpoint of an exact science . . . There's no guesswork with Nalco.

Take our advice Joe, and call for a Nalco survey today . . . let us show you what Nalco can do to overcome corrosion in *your* plant. There's no obligation.

Nalco

NATIONAL ALUMINATE CORPORATION
6222 West 66th Place Chicago, Illinois

Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario

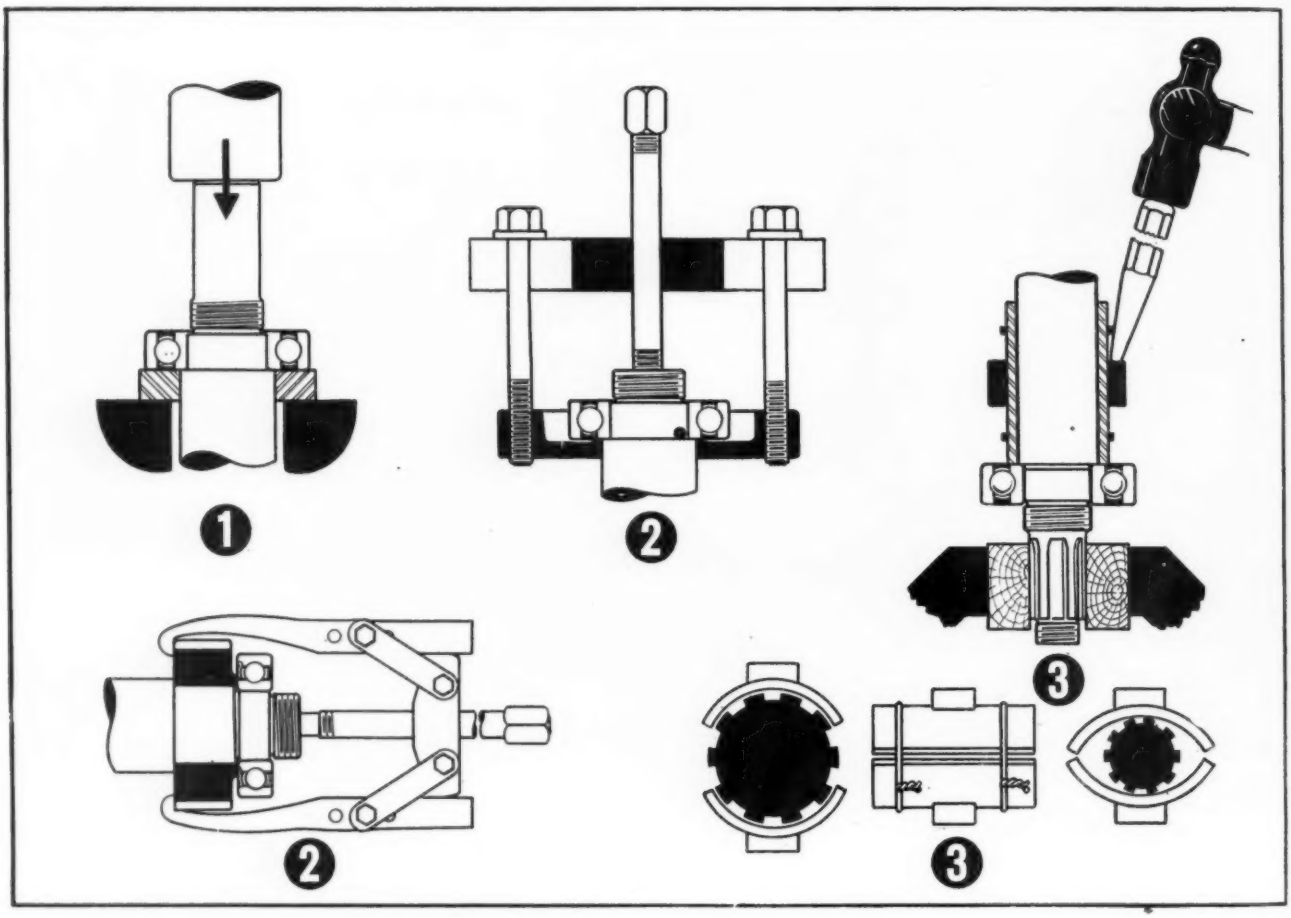
. . . The Complete Water Treating Service

HOW TO AVOID DAMAGING BALL BEARINGS

BECAUSE they are vitally needed in practically all fighting equipment, ball bearings have become one of the hard-to-get items. Thus it is more important than ever to get the utmost service out of the ones in vital homefront equipment. Keep new bearings sealed in the original containers to prevent rusting and damage.

Balls and rings are hard all the way through. Precision tolerances result in a high surface finish, especially of the balls and raceways. Any abrasion or injury to these contacting surfaces leads to spalling and premature failure. Ball-bearing maintenance must avoid: (1) blows or force that damages balls or raceways (2) intrusion of dirt or metal chips into the bearing (3) incorrect lubricants.

Handling bearings correctly when overhauling equipment keeps a great many in use that otherwise would have to be scrapped. *Courtesy of New Departure Div, General Motors Corp.*



1 Ball bearings nearly always fit tight on the shaft but are a push fit in the housing. Therefore more care is needed when removing them from the shaft. An arbor press serves best for demounting and should be used whenever possible. Rest the bearing inner ring or both rings (never the outer ring alone) on a pair of flat blocks. Then use a firm, steady pressure to force the shaft out.

Use extreme care and keep the shaft straight to avoid damage from cocking and do not allow it to fall to the floor when suddenly released. Also do not drop the ball bearing.

2 When a press is not available or adaptable, use a suitable puller which can be inserted behind the bearing inner race. Be sure to set the jaws so they cannot slip and damage the separator or shield when applying pressure. Adjust the jaws for a straight pull, then exert an even pressure. A cocked bearing damages both shaft and inner race. When gears or other removable parts interfere with pulling the bearing alone, pull them as a unit.

Never use a hammer and drift directly on the bearing because you may damage the separator or shield.

3 If you *must* use a hammer, provide split sections of pipe fitted with welded lugs for different-sized shafts. Thus, hammer blows are evenly distributed and if struck alternately on opposite sides of the shaft serious cocking is avoided. Concentrated blows may crack a tight-fitting inner race. Be sure pipe is free of chips or rust that would fall into the bearing. When removing a bearing by pounding, be careful not to hit or scrape locknut threads on the shaft. Wrap bearings in paper or cloth and do not spin them when dirty. This may cause scratches and spalling.

Something new has been added to diesel engine cylinder liners—a new process to lengthen cylinder liner life and give the engine greater reliability—more hours of continuous operation.

Chrome-plate, applied to cylinder liner bores, multiplies liner life 4 to 20 times, ring life 3 to 5 times, and reduces the risk of piston seizure.

Every Baldwin diesel engine now coming from the production line is fitted with chrome-plated cylinder liners.

All this adds up to more satisfactory service and lower maintenance cost for your Baldwin diesel.

Baldwin 4-cycle diesel engines are serving railroad, marine, pipe line, power house and other industrial installations—capacities from 150 to 1,050 horsepower.

The Baldwin Locomotive Works, Locomotive & Ordnance Division, Philadelphia, Pennsylvania, U.S.A. Offices: Philadelphia, New York, Chicago, Washington, Boston, Cleveland, St. Louis, San Francisco, Houston.

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DIESEL ENGINES

FOR THE ENGINEER'S BOOKSHELF

HYDRAULIC AND PNEUMATIC LEATHER PACKING HANDBOOK ..... *By Houghton Leather Research Staff*
MARINE PIPEFITTING ..... *By Verne E Hase and Ralph W Allen*
AUTOMATIC CONTROL ENGINEERING ..... *By Ed Sinclair Smith*
RESULTS OF PUBLICLY OWNED ELECTRIC SYSTEMS ..... *By Burns & McDonnell Engrg Co*
CENTRIFUGAL PUMPS AND BLOWERS ..... *By Austin H Church*
MANUAL OF ASTM STANDARDS ON REFRACTORY MATERIALS ..... *By ASTM Committee C-8 on Refractories*
ELECTRONICS: TODAY AND TOMORROW ..... *By John Mills* **BOOKLETS** ..... *Brief Reviews*

Leather Packing

HYDRAULIC AND PNEUMATIC LEATHER PACKING HANDBOOK (1944) *By Houghton Leather Research Staff. Published by E F Houghton & Co., 303 W Lehigh Ave., Philadelphia, Pa.* 175 *pp*, 6x9, 114 *illustrations*, 20 *tables, semi-flexible binding.* $1.00.

Hydraulics and pneumatics have become of increasing interest to most engineers and with these subjects comes an interest in packing. Presses, valves, hoists, pumps and similarly controlled machinery are a source of annoyance and expense when improperly packed. Cost of packing may be small, but when it fails, production loss and the attendant expense may be serious. Therefore it is important, as this book explains, that packing be properly selected and installed, and working surfaces kept in good condition.

Among the important chapters are: packing leather, design and support of packing, common troubles, compression versus mechanical packing, leather-packing spring expanders, storage and care of leather packing. There is an appendix of engineering reference tables and data. Many cross-section drawings show the proper installation of "V", flange, "U" and cup leather packings. Written in language easily understood by a mechanic, the book is useful to everyone who has packing problems.

Pipefitting

MARINE PIPEFITTING (1944) *By Verne E Hase and Ralph W Allen. Published by McGraw-Hill Book Co, Inc, 330 W 42nd St, New York 18, N. Y.* 325 *pp*, 5½x8¾, 263 *illustrations, cloth*, $3.00.

Here is a book on actual, everyday problems in pipefitting, written for the man on the job. Even though it is primarily for the marine pipefitter, the methods of fabricating pipe for intricate angle bends, as described, make it a valuable addition to the power engineer's library.

You will find the answers to such problems as these: Crowded conditions in a power plant sometimes make it necessary to change the direction of pipe runs continually. Moreover, when standard fittings do not fit a layout the only remedy is a miter bend designed to the proper radius.

Several chapters on mathematics give the pipefitter enough geometry and trigonometry to work with angles and their functions. Chapters on tools, silver brazing, various piping systems and plan reading are especially valuable to the apprentice pipefitter.

Control Engineering

AUTOMATIC CONTROL ENGINEERING (1944) *By Ed Sinclair Smith, research engineer, Eclipse-Pioneer Division, Bendix Aviation Corp. Published by McGraw-Hill Book Co, 330 W 42nd St, New York, N. Y.* 369 *pp*, 5½x8½ *in., illustrated*, 11 *tables, cloth.* $4.

Practically every industrial operation is under partial or complete automatic control. Since control is control irrespective of its application, the author's attack on the problem is fundamental, not tied to analogies, plants or processes. The first four chapters are practical, dealing with the art-of-control terminology, descriptive treatment of control and application of regulators. The next three chapters give a mathematical analysis of control problems and their various aspects. Then follow five appendices that contain tables commonly used in control problems, a review of basic physics, mathematics and a bibliography of literature on automatic control and metering.

This book grew out of a Government ESMDT course in control engineering given by the author at Pratt Institute. After practical trial of his methods of instruction he expanded the material into the present volume.

Electric Systems

RESULTS OF PUBLICLY OWNED ELECTRIC SYSTEMS (1944, *eighth edition*) *Burns & McDonnell Engineering Co, 107 W Linwood Blvd, Kansas City 2, Mo.* 450 *pp*, $10.00.

This electric rate book shows the operating records, earnings, output, rates, net revenue, valuation and other information on use and cost of electricity in 767 publicly owned systems. City officials, operators and managers of both private and municipal systems will find these operating records of much interest and value. It is the only book that gives rate schedules and reliable statistics of public operation.

Pumps and Blowers

CENTRIFUGAL PUMPS AND BLOWERS (1944) *By Austin H Church, Associate Professor of Machine Design, New York University. Published by John Wiley & Sons, Inc, 440 4th Ave, New York, N. Y.* 308 *pp*, 5½x8½ *in.; illustrated; cloth binding.* $4.50.

Because centrifugal-pump-and-blower design has developed rapidly during recent years, the fields of application of these machines have extended accordingly, giving them an importance that is not fully appreciated. This book, which attempts to correct the condition, is intended for young graduate and practicing engineers who deal with centrifugal-pump-and-blower problems.

(*Continued on page* 184)

POWER Shortage—What to Do About It

Because paper is critically short POWER's circulation is unavoidably frozen at present levels. That's why over 2000 engineers who want to subscribe today cannot be served—are on the waiting list. Established subscribers coming up for renewal don't have to wait if they get their orders in promptly, but some have let their subscriptions lapse and have thereby lost their priority. When that happens, it takes from one to three months to get back on the lists—and generally there is no way to buy, borrow, beg or steal the numbers missed.

To insure unbroken service and to protect yourself from inconvenience, the editors urge you to renew promptly on receipt of first notice. Sorry—it's war!

A 65,000 sq. ft. public utility surface condenser under construction in the plant of C. H. Wheeler Manufacturing Company at Philadelphia. The tube sheets, 264" x 234", were assembled from Anaconda Muntz Metal plates, 1½" thick.

Anaconda Tube Sheets in a number of alloys are supplied in circles, half circles, segments, rectangles and squares, as well as in special shapes such as those supplied for this condenser. These plates are accurately alloyed, commercially flat, readily machinable and true to dimension.

Should you desire assistance in the solution of condenser or heat exchanger problems, the Technical Department of The American Brass Company is at your service. For complete information on alloys and methods of manufacture, send for Publication B-2, "Anaconda Tubes and Plates for Condensers and Heat Exchangers." 44180

ANACONDA

Anaconda Copper & Brass

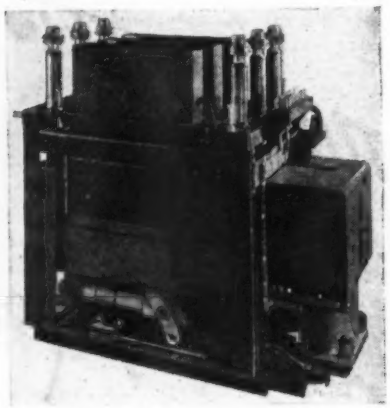
THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company—In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

What's New in Plant Equipment

Air Circuit Breaker

FOR VERTICAL-LIFT metal-clad switchgear equipment, *Ruptair* magnetic air circuit breaker is available in high voltage, oil-less switchgear rated 5000 v and below, and 150,000 kva interrupting capacity and below. *Ruptair* breaker has over-all dimensions as compact as standard oil-breaker switchgear, with all parts readily accessible.



The arc chute has been coordinated with the contact and arc-runner design to give consistent and reliable interruption through entire current range to be interrupted. The magnetic circuit, consisting of one husky blowout coil and two laminated iron pole pieces per phase, is arranged to force the arc up into arc chute immediately upon separation of arcing contacts. Self-contained contact assembly can be inspected and maintained without disturbing arc chute or magnetic circuit. *Allis-Chalmers Mfg Co, Milwaukee, Wis.*

Conduit Housing

HELICAL CORRUGATED CONDUIT HOUSING for Ric-wiL prefabricated insulated pipe units now has a reinforcing full-welded lock seam extending spirally the entire length of each section. Automatic machine weld is made at the factory before galvanizing, assuring a permanent, pressure-tight, waterproof structure. *Ric-wiL Co,* 1572 *Union Commerce Bldg, Cleveland, Ohio.*

Snap-Action Air Trap

HIGH PRESSURE SNAP-ACTION air trap, No. 71-315, for draining water from compressed-air systems under pressures up to 1000 lb has forged-steel body and cap. Ball float withstands hydrostatic pressure of 1500 lb and is connected to the short valve lever through a flat strip of stainless-steel spring. An initially concave bent spring is so attached to the float that as the incoming water raises the float, the spring moves past dead-center and snaps float up, which throws valve wide open. Drainage is immediate. When water level drops, cycle is reversed and valve snaps tight in closing. No throttling occurs and wire drawing is claimed to be eliminated. Manufacturer states that the trap handles all ordinary oil and dirt without clogging. *Armstrong Machine Works, Three Rivers, Mich.*

Air Cleaner

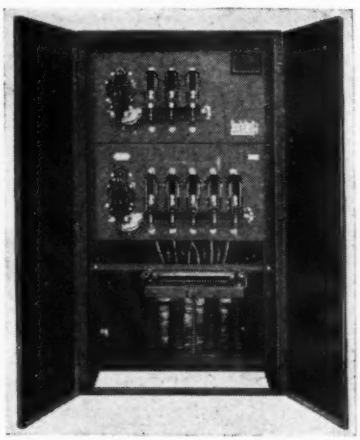
AEROTEC TUBE is self-cleaning with a constant-pressure characteristic. It is highly efficient in eliminating abrasive material, yet occupies little space and adds an absolute minimum in weight. Often the high precipitating efficiency of the tube eliminates need of an after cleaner. There is no pressure build-up because dust is discharged to a storage receptacle when precipitated. *Aerotec Co, Thermix Engrg Co, Greenwich, Conn.*

Step-Valve Pump

DESIGNED FOR CONTROLLED VOLUME PUMPING against negative differential pressures, step-valve pump retains all essential features of Milton Roy double-ball check valve. Outside spring-loading provides ready adjustment for desired load. Removable single-cover plate provides complete accessibility without disturbing intake or discharge piping. Valve affords freedom from air binding. There is minimum restriction of passages as pumped liquid moves in an almost straight line under ball checks, not around them. This valve is available with Milton Roy pumps in capacities from 10 to 1300 gph and is for pumping viscous materials, such as liquid latex, acid sludges, tars and asphalts, salt slurries, etc. *Milton Roy Pumps,* 1305 *E Mermaid Ave, Philadelphia, Pa.*

Weld-Cleaning Tool

COMBINING WIRE BRISTLE BRUSH and slag-removing head in one unit, the Atlas Model *A Dual-Tool* is an improved weld-cleaning tool. It features a brush holder which permits removal for reversing or replacing brush. *Flex-O* spring-steel handgrip, permanently welded to handle, eliminates loosening or breaking. Chipping head is hand-forged tool steel. All parts replaceable. *Atlas Welding Accessories Co, 14824 Wyoming Ave, Detroit 21, Mich.*



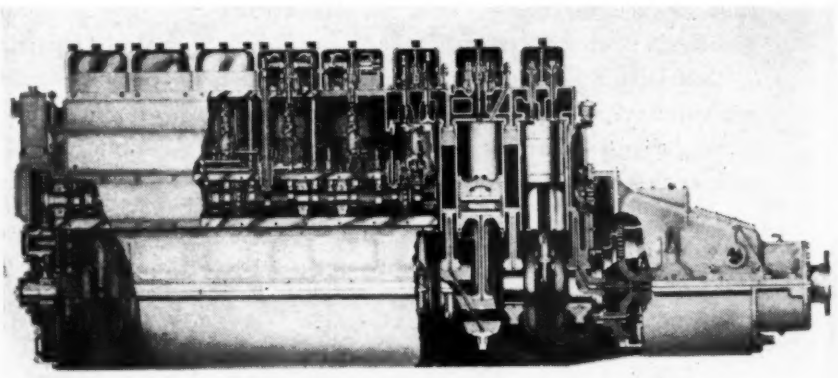
Motor Starter

MAGNETIC REDUCED-VOLTAGE squirrel-cage starter has an accurately calibrated thermal-overload relay to protect motors from sustained overload, locked rotor, single-phasing and overloading from too frequent starting. Built for general industrial applications, *Arc* starter is now available for motors from 5 to 2500 hp, up to 5000 v, 3-phase, 50-or 60- cycle. Interrupting capacity rating is ten times motor's full-load current. *Allis-Chalmers Mfg Co, Milwaukee, Wis.*

Diesel Engines

MEDIUM-DUTY DIESEL ENGINES ranging from 250 to 650 hp have been developed for marine and industrial use. Four Viking models consist of supercharged 6-cylinder, unsupercharged 6-cylinder, supercharged 8-cylinder and unsupercharged 8-cylinder. The Viking diesel (below) provides a power

(*Continued on page* 140)



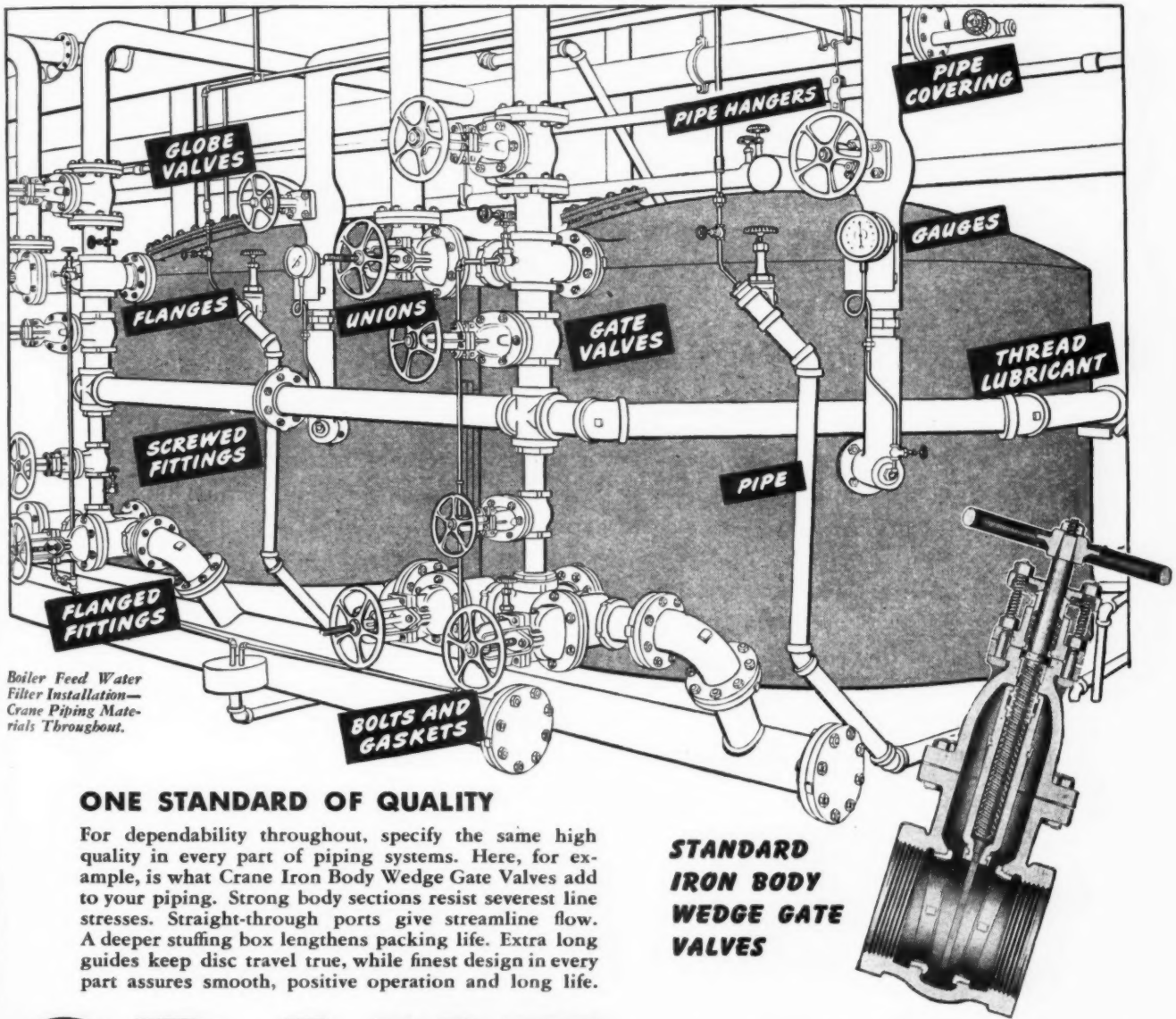
You name the Piping Service CRANE supplies the Equipment

ONE SOURCE OF SUPPLY . . . ONE RESPONSIBILITY FOR ALL MATERIALS

Valves—fittings—pipe—fabricated assemblies—and piping accessories—for power or processing lines—high, moderate, or low pressure—all your needs for any installation are available from a single source: Crane. Just name the fluid to be handled—your Crane Branch offers the world's greatest selection of quality materials—in brass, iron and steel—for every piping service.

Better installations start with parts whose quality and craftsmanship are backed by a single responsibility. Ordering, maintenance work, storing of parts and getting emergency replacements—all such steps are simplified by Crane *complete* materials service. Your satisfaction with Crane products is assured by Crane Co.'s 89-year experience and leadership in the piping equipment field.

CRANE CO., General Offices: 836 South Michigan Avenue, Chicago 5, Illinois. *Branches and Wholesalers Serving All Industrial Areas.*



Boiler Feed Water Filter Installation—Crane Piping Materials Throughout.

ONE STANDARD OF QUALITY

For dependability throughout, specify the same high quality in every part of piping systems. Here, for example, is what Crane Iron Body Wedge Gate Valves add to your piping. Strong body sections resist severest line stresses. Straight-through ports give streamline flow. A deeper stuffing box lengthens packing life. Extra long guides keep disc travel true, while finest design in every part assures smooth, positive operation and long life.

STANDARD IRON BODY WEDGE GATE VALVES

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

Paradoxes of Paper . . .

For decades, such expressions as "just a scrap of paper" and "not worth the paper it's written on" have been familiar to every American. We thought of paper as a material for wrapping packages and starting fires, and laughed at the Japs for their paper houses.

Suddenly, all that is changed. Lumberjacks, like other working men, are either in the Services or making big money in war plants. The Army and Navy take half of every tree cut for lumber, then half of the quarter or so that finds its way to a pulp mill. War plants take another quarter of our paper output—and we begin to realize how many purposes paper serves in our everyday lives. Sure, it's in our newspapers and magazines, but it's also in our writing papers, our tissues, our packaging, and in a thousand little conveniences. Now there isn't enough paper to go around.

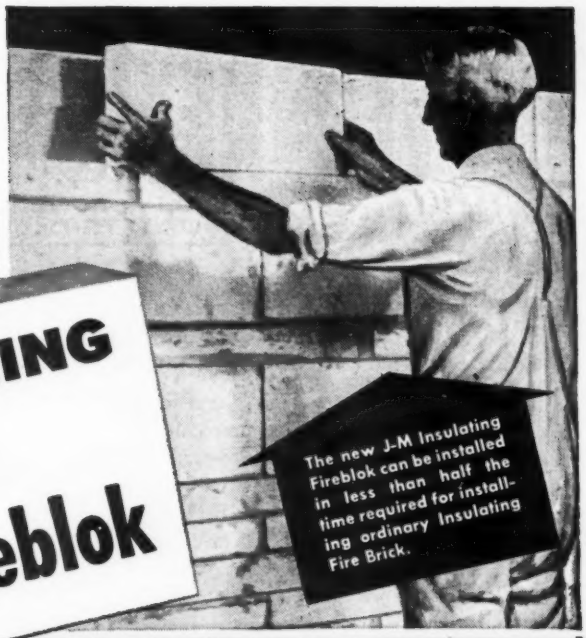
Under the press of war needs, the Services have developed paper raincoats that can be torn off in battle, waterproof paper packages that can be floated ashore, paper packing for delicate instruments and machines, cartons for shells and food and blood plasma, paper covers for bomb fins, and so on through an almost endless list. Estimators have said there are 2800 different military uses, plus the obvious packaging of three-quarters of a million kinds of fighting supplies. All this is piled on top of such evident uses as correspondence and blueprints. And such paper, usually waterproofed or otherwise treated, is hard to salvage to make into new forms—even if we dared expect our fighting men to stop fighting while they pick up paper scraps to send back to us.

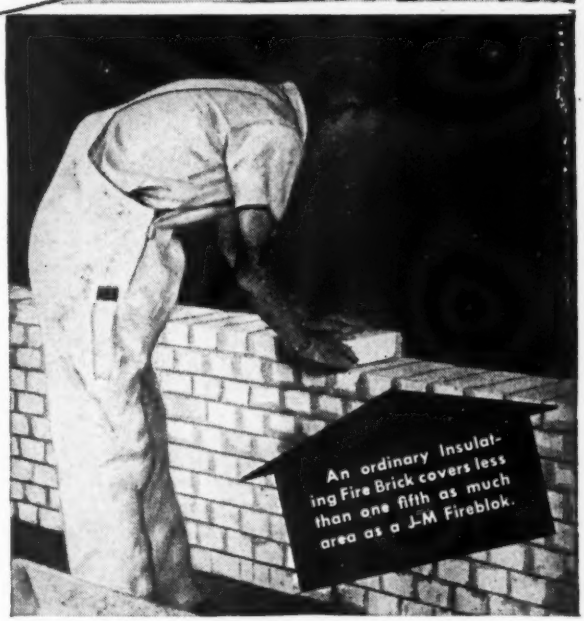
All that adds up to just one thing—every scrap of paper is precious. We already are saving and salvaging 62% of civilian paper voluntarily, against British saving of 70% by Government order and threat of penalty. But we must do better. We are supplying the rest of the Allies with our products—which must be packed in *our* "waste" paper. Let's push that 62% up to the top!

George Edwards
Engineer

LESS DOWN TIME

FOR FURNACE RELINING with big, new J-M Insulating Fireblok


The new J-M Insulating Fireblok can be installed in less than half the time required for installing ordinary Insulating Fire Brick.



ONE OF THE NEW LIGHTWEIGHT Johns-Manville Insulating Fireblok covers more surface than five Insulating Fire Brick. So, when you reline furnaces with it, you can often get the job finished several times faster. Consider how many hours this can save you in down time, in maintenance crew time . . . and how much faster your furnaces can get back into profitable production.

The larger, more convenient size is the only difference between J-M's four new Insulating Fireblok and the four well-known J-M Insulating Fire Brick. Either size of these four grades of highly efficient refractory linings for use from 1600° F. to 2600° F., has these important advantages:

Easy cutting and fitting—J-M Fireblok can be easily cut with a saw and shaped with a rasp. Most special shapes can be either shop or field cut from standard slabs, reducing the inventory of special shapes.

Minimum of joints—the large size, compared to the standard fire brick unit, materially reduces the number and length of joints, resulting in a thermally more efficient construction.

Economical bonding—with reduced joint length Fireblok requires a minimum of air-set cement for bonding. (J-M 1626 Cement was especially developed for this use.)

Uses—Fireblok can be used wherever Insulating Fire Brick are recommended such as for heat-treating furnaces, flues, stacks, mains and similar equipment. Also for the lining of doors, suspended arches, and, when tapered, for sprung arches of exceptional stability.

Write for new booklet, IN-103A, on this J-M development. Johns-Manville, 22 East 40th St., New York 16, New York.

MOST WIDELY USED BACK-UP INSULATION BETWEEN 600° F. and 1900° F.—J-M SUPEREX

Made of high-quality, calcined diatomaceous silica and bonded with asbestos fiber, Superex combines all the desirable qualities of these two insulating materials. Result: High heat resistance and exceptional insulating efficiency. Ideal for boiler walls, furnaces, etc. Available in 3", 6", 9" and 12" by 18" and 36" blocks. Other lengths to order. Various thicknesses.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville INDUSTRIAL INSULATIONS

FOR EVERY TEMPERATURE . . . FOR EVERY SERVICE

POWER NEWS

BUSINESS ITEMS AND APPOINTMENTS • WASHINGTON NOTES

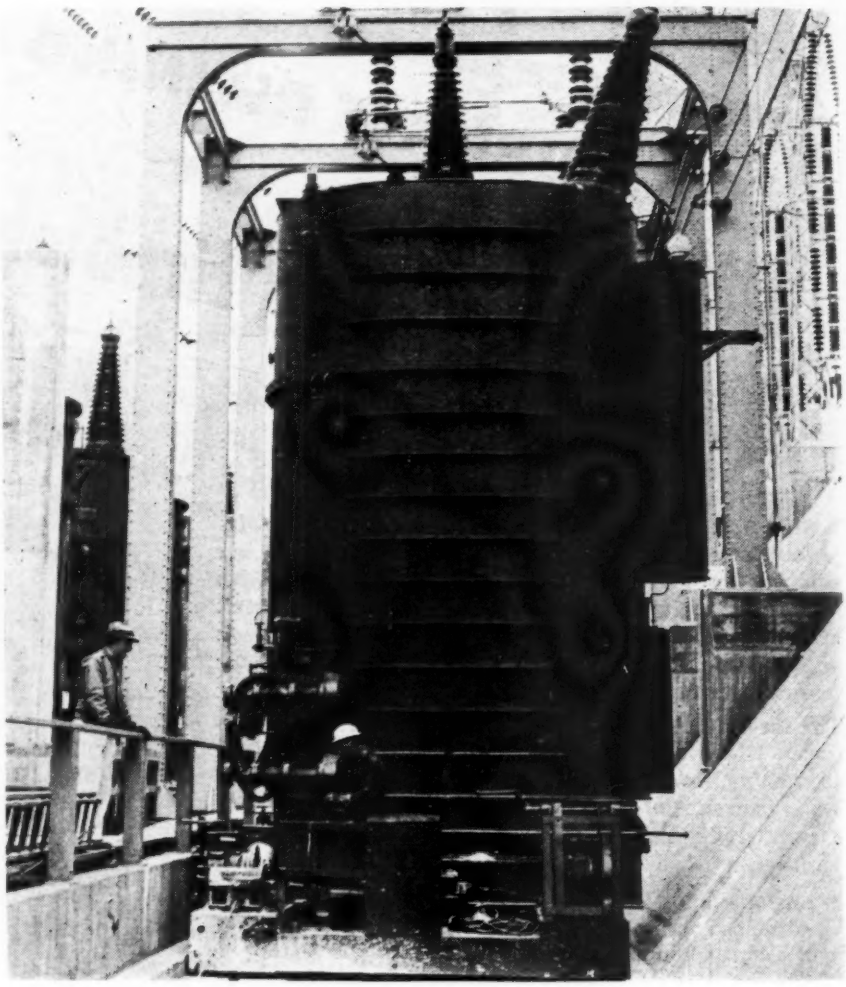
CONVENTIONS • WAR AND POSTWAR POINTERS • COAL MISCELLANY

75-Ton Transformer Makes Grand Tour

Six railroad systems recently hauled a 75-ton 25,000-kva transformer 3500 miles through nine Western states, to deliver it a direct distance of only 700 miles from Grand Coulee dam in the state of Washington to California's Shasta dam. By the circuitous route, the 18-ft-high transformer avoided tunnels and low underpasses.

An extra-length, underslung freight car was employed for shipping the transformer. Photo shows the unit as it was removed from the transformer deck at Grand Coulee preparatory to mounting it on the freight car for its long journey.

The transformer had served as a spare for two 75,000-kw GE generators, temporarily transferred to Grand Coulee from Shasta to provide additional power for war industries. It was ordered returned to the Shasta power plant, for which it was designed; the generators will also be returned to Shasta after the war.



This 75-ton 25,000-kva transformer was routed 3500 miles from Grand Coulee in Washington to Shasta dam in California, a direct distance of only 700 miles. By out of the way shipment the 18-ft-high unit avoided tunnels and low underpasses.

New Codes for Bituminous And Anthracite Stokers

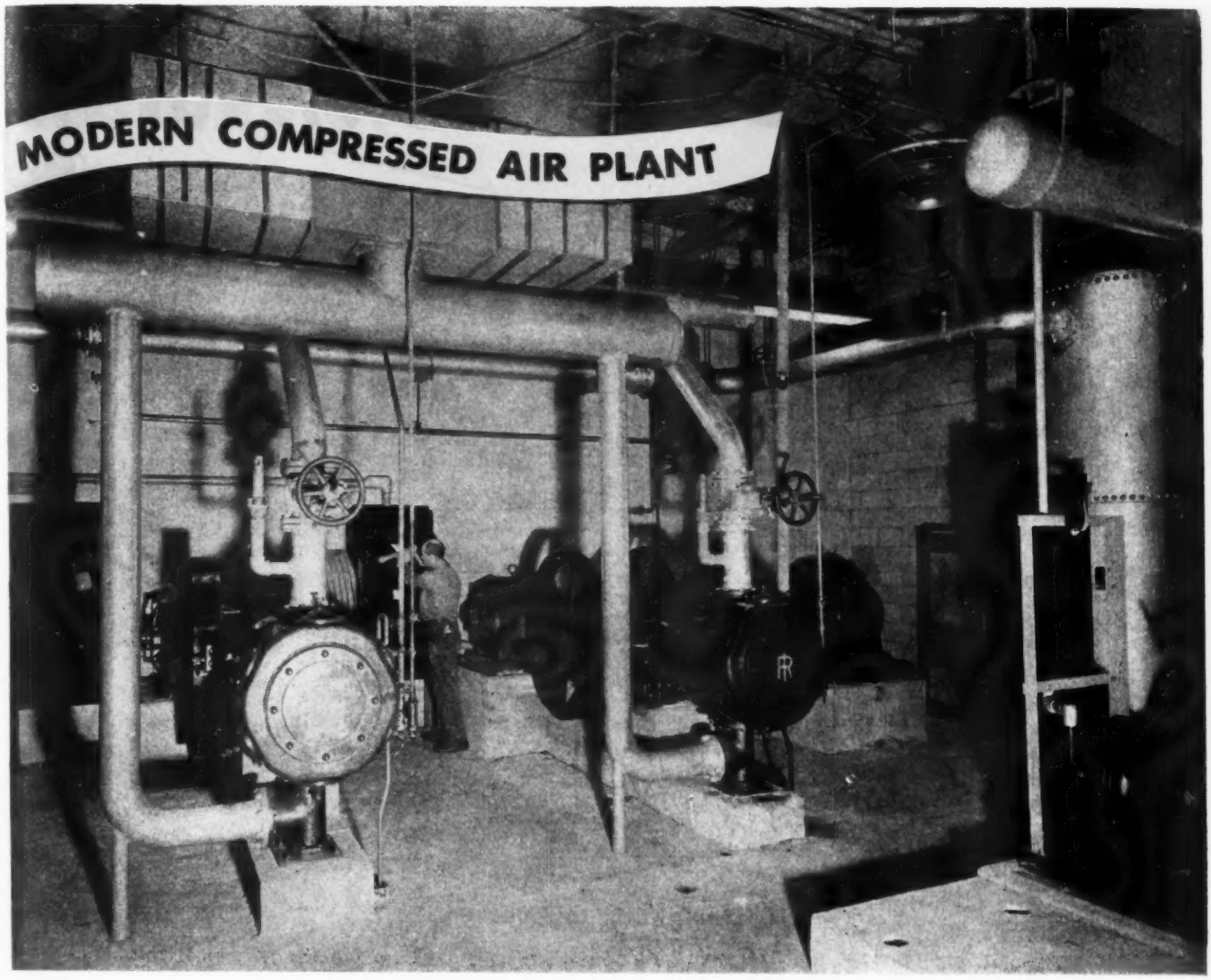
After more than two years of study, conferences and investigation, the stoker manufacturing industry through its national organization, the Stoker Manufacturers' Assn, has established standard codes to determine rated capacities of both bituminous and anthracite underfeed stokers. J M McClintock, president, and A O Dady, chairman of the engineering and research committee, made the joint announcement. Mr McClintock said that adoption of these codes is a further step in the stoker industry's program to standardize and establish recognized and authoritative uniform methods, which cover the technical application of stoker equipment.

The codes, which provide a uniform method for testing and rating underfeed-stoker equipment up to 1200 lb of coal per hour capacity, were unanimously approved and adopted at the association's recent annual meeting and war conference, held at French Lick, Indiana.

Under the provisions of the two codes—one covering bituminous stokers and the other anthracite—manufacturers complying with the SMA standard rating guarantee that their equipment in the various sizes and models will feed and burn coal, or coals, of a standard specification, or specifications, and under certain draft and operating conditions at the rated capacity in pounds per hour continuously "when properly installed, adjusted and attended in furnaces no smaller than specified in the SMA Recommended Furnace Dimensions."

Simultaneously with the release of these new codes, Mr Dady stated that the association's engineering and research committee is trying hard to complete a new stoker engineering and technical manual for publication and distribution as early as possible. It will include the various SMA standards and recommendations, as well as other technical and practical information designed to be of the greatest possible value to stoker-equipment users, consulting engineers, architects, heating

(*Continued on page* 188)



Uses Timken Bearing Equipped Compressors

The above photograph shows two Ingersoll-Rand 15 x 11 ES Air Compressors rated at 50 lbs. discharge supplying air for cooling gas furnaces, for high-pressure gas jets used in glass molding, etc.

Some of the air is reduced to 30 lbs. and used to drive air motors of agitators for mixing inflammable liquids.

Ingersoll-Rand has been applying Timken Tapered Roller Bearings to the crank shafts of compressors for years and knows that wherever anti-friction performance is sought, Timken Bearings assure it in full.

For the bearings used on crank shafts must be capable of performing other vital functions besides eliminating friction. They must be able to carry radial, thrust and combined loads; they must be able to hold moving parts in correct and constant alignment.

This versatility figures importantly in the success of Timken Tapered Roller Bearings wherever they are used. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

Citation... for the

OXFORD PAPER COMPANY

GENERAL OFFICES
230 PARK AVENUE

NEW YORK 17, N.Y.

July 31, 1944

J. EVERETT SHEA
MANAGER PURCHASING DEPARTMENT

Jenkins Bros.
80 White Street
New York, N.Y. Attn: F. C. Ernst, Chief Engineer

Gentlemen:

The information you sent on the new Malleable Iron Valves is just what we needed, and our engineers are considering their use for the special service we described to you.

For several years, now, we have been installing Jenkins Valves in the toughest spots on our process lines, and if we ever needed any justification of our choice, we have certainly had it since the war greatly increased our operating schedules.

Meeting the demand for map paper, packaging paper, and other special stocks for the armed forces, and for the endless varieties needed by war plants, has kept us going full tilt. There hasn't been any time to nurse along "sick" valves. Fortunately, in spite of the punishment they've taken, our Jenkins Valves haven't needed any more attention than normal maintenance, and that was often pretty sketchy.

All told, we think you've got a product that has done a tough wartime job with extraordinary merit.

Very truly yours,

J. Everett Shea

JENKINS VALVES

SINCE 1864

Veterans of a never-ending Battle

Paper-makers depend on Jenkins Valves where pipelines must do *extra* duty...

When America entered the war, the paper industry began a battle which is still in progress. It is the fight to supply the endless needs of the armed forces and war industry for paper products of every description.

The Oxford Paper Company, one of the industry's largest producers, has worked its plant far beyond its normal peacetime capacity in the past 2½ years, turning out *a thousand miles of paper a day.*

Even in normal times, there are no tougher spots for valves than in paper mill services, because of corrosion, clogging, etc. With pipelines doing *extra* duty, only valves of exceptional endurance could set such a gratifying record of trouble-free performance as that reported for the Jenkins Valves in the Oxford Mills, in Rumford, Maine.

Such performance is no accident. It is the direct result of the better design, better materials, better workmanship of Jenkins Valves. But only the gruelling tests of war emergency could offer such convincing proof of their super-endurance.

Let this war record – only one of many "citations" that are coming in from leading producers in many industries – guide you in specifying valves for reconversion and renovation in your plant. You'll find it will "cost least in the long run" to specify Jenkins Valves – for every industrial, engineering, marine, or plumbing-heating service.

Jenkins Bros., 80 White St., New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; Jenkins Bros., Ltd., Montreal; London.

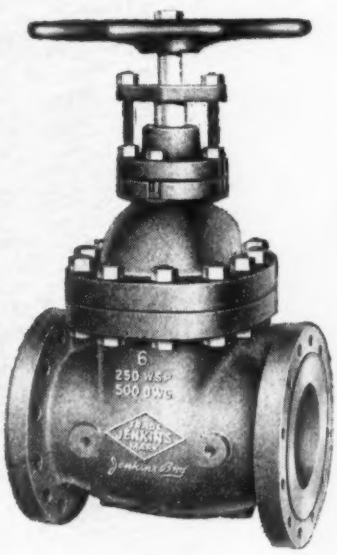
REG. U.S. PAT. OFF. TRADE JENKINS MARK

Jenkins Bros

PROCUREMENT EXPERT . . . . . FOR YOUR POST-WAR PLANNING BOARD

Your Jenkins Distributor has a complete picture of the valve supply picture at all times. He can keep you informed about valves available, aid you in selection, and provide the help of Jenkins Engineering Service for special problems.

His distinguished service to war industry, often in the face of baffling supply conditions, has prepared him even better than ever to give you the help you'll need for reconversion.



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POWER'S DATA SHEETS

Number 145

Temperature-Superheat Table for Throttling Steam—II

▶ This continuation of Mr Pohlig's convenient table lists final temperature and degrees of superheat for steam that is throttled from a higher pressure to a lower pressure without appreciable addition or loss of heat. Part I, in August POWER, showed values for a low range of enthalpy, this table a higher range—all based on Keenan and Keyes steam tables (John Wiley & Sons. 1936 edition). Temperatures are in boldface type, degrees of superheat in lightface. Following any column vertically downward tells change of condition of steam after throttling.

Pressure abs, psi	*Steam temp sat, F*	*Total heat, Btu per lb*	*Enthalpy — Btu per lb*																			
			1255	1260	1265	1270	1275	1280	1285	1290	1295	1300	1305	1310	1315	1320	1325	1330	1335	1340	1345	1350
265	406	1201.2	84 490	93 499	101 507	110 516	119 525	128 534	137 543	146 552	155 561	165 571	174 580	183 589	192 598	201 607	211 617	220 626	229 635	239 645	248 654	257 663
255	403	1200.8	85 488	94 497	102 505	111 514	120 523	129 532	138 541	148 551	157 560	166 569	175 578	184 587	194 597	203 606	213 616	222 625	231 634	241 644	250 653	259 662
246	400	1200.4	86 486	95 495	104 504	113 513	122 522	131 531	140 540	149 549	158 558	168 568	177 577	186 586	196 596	205 605	214 614	224 624	233 633	242 642	252 652	261 661
236	396	1199.9	88 484	97 493	106 502	115 511	124 520	133 529	142 538	151 547	161 557	170 566	179 575	189 585	198 594	208 604	217 613	226 622	236 632	245 641	255 651	264 660
226	392	1199.3	90 482	99 491	108 500	117 509	126 518	135 527	144 536	154 546	163 555	172 564	182 574	191 583	201 593	210 602	220 612	229 621	239 631	248 640	257 649	267 659
216	388	1198.8	92 480	101 489	110 498	119 507	128 516	137 525	147 535	156 544	165 553	175 563	184 572	194 582	203 591	213 601	222 610	232 620	241 629	251 639	260 648	270 658
206	384	1198.1	94 478	103 487	112 496	121 505	130 514	140 524	149 533	158 542	168 552	177 561	187 571	196 580	206 590	215 599	225 609	234 618	244 628	254 638	263 647	273 657
196	380	1197.5	96 476	105 485	114 494	123 503	133 513	142 522	151 531	161 541	170 550	180 560	189 569	199 579	208 588	218 598	228 608	237 617	247 627	256 636	266 646	275 655
186	376	1196.8	98 474	107 483	116 492	125 501	135 511	144 520	154 530	163 539	172 548	182 558	192 568	201 577	211 587	221 597	230 606	240 616	249 625	259 635	269 645	278 654
176	371	1196.0	100 471	110 481	119 490	128 499	138 509	147 518	157 528	166 537	176 547	186 557	195 566	205 576	214 585	224 595	234 605	243 614	253 624	263 634	272 643	282 653
166	367	1195.1	102 469	111 478	121 488	130 497	140 507	149 516	159 526	169 536	178 545	188 555	197 564	207 574	217 584	227 594	236 603	246 613	256 623	266 633	275 642	285 652
156	362	1194.1	105 467	114 476	124 486	133 495	143 505	152 514	162 524	172 534	181 543	191 553	201 563	211 573	221 583	230 592	240 602	250 612	260 622	269 631	279 641	289 651
146	356	1193.1	109 465	118 474	128 484	137 493	147 503	157 513	166 522	176 532	186 542	196 552	205 561	215 571	225 581	235 591	245 601	254 610	264 620	274 630	284 640	294 650
136	351	1191.9	112 463	121 472	131 482	140 491	150 501	160 511	169 520	179 530	189 540	199 550	209 560	219 570	229 580	238 589	248 599	258 609	268 619	278 629	288 639	297 648
126	345	1190.6	115 460	125 470	135 480	144 489	154 499	164 509	174 519	184 529	193 538	203 548	213 558	223 568	233 578	243 588	253 598	263 608	273 618	282 627	292 637	302 647
116	339	1189.2	119 458	129 468	138 477	148 487	158 497	168 507	178 517	188 527	198 537	208 547	218 557	228 567	237 576	247 586	257 596	267 606	277 616	287 626	297 636	307 646
106	332	1187.6	124 456	133 465	143 475	153 485	163 495	173 505	183 515	193 525	203 535	213 545	223 555	233 565	243 575	253 585	263 595	273 605	283 615	293 625	303 635	313 645
96	325	1185.8	128 453	138 463	148 473	158 483	168 493	178 503	188 513	198 523	208 533	218 543	228 553	238 563	249 574	259 584	269 594	279 604	289 614	299 624	309 634	319 644
86	317	1183.8	134 451	144 461	154 471	164 481	174 491	184 501	194 511	204 521	214 531	225 542	235 552	245 562	256 572	266 582	276 592	286 602	296 612	306 622	316 632	326 642
76	309	1181.5	140 449	150 459	160 469	170 479	180 489	190 499	201 510	211 520	221 530	231 540	241 550	251 560	261 570	272 581	282 591	292 601	302 611	312 621	322 631	332 641
66	299	1178.8	148 447	158 457	168 467	178 477	188 487	198 497	209 508	219 518	229 528	239 538	249 548	260 559	270 569	280 579	290 589	300 599	311 610	321 620	331 630	341 640
56	288	1175.7	156 444	166 454	177 465	187 475	197 485	207 495	218 506	228 516	238 526	249 537	259 547	269 557	279 567	290 578	300 588	310 598	320 608	330 618	341 629	351 639
46	276	1171.9	166 442	176 452	186 462	197 473	207 483	217 493	228 504	238 514	249 525	259 535	269 545	279 555	290 566	300 576	310 586	321 597	331 607	341 617	351 627	362 638
36	261	1167.2	178 439	189 450	199 460	210 471	220 481	230 491	241 502	251 512	262 523	272 533	283 544	293 554	303 564	314 575	324 585	334 595	345 606	355 616	365 626	375 636
26	242	1161.0	195 437	205 447	216 458	226 468	237 479	247 489	258 500	268 510	279 521	289 531	300 542	310 552	321 563	331 573	341 583	352 594	362 604	372 614	383 625	393 635
20	228	1156.0	208 436	218 446	229 457	239 467	250 478	260 488	271 499	281 509	292 520	302 530	312 540	323 551	334 562	344 572	355 583	365 593	375 603	386 614	396 624	406 634
16	216	1151.8	218 434	229 445	240 456	250 466	261 477	272 488	282 498	293 509	303 519	314 530	324 540	335 551	345 561	355 571	366 582	376 592	387 603	397 613	407 623	418 634

Charles A Pohlig

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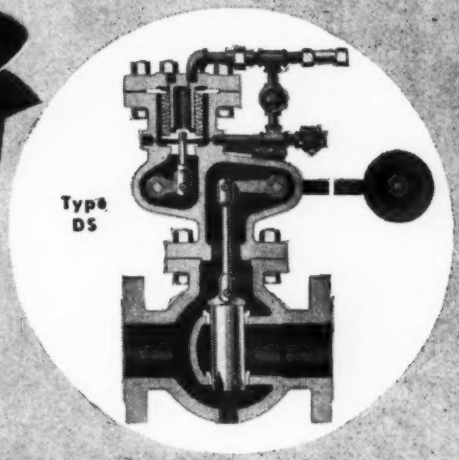
Effective FEED WATER *Control*

BEGINS AT THE PUMP GOVERNOR...

Boiler feed control properly begins at the feed pumps, through maintenance of fixed excess pressures. For this purpose it pays to specify Copes Pump Governors.

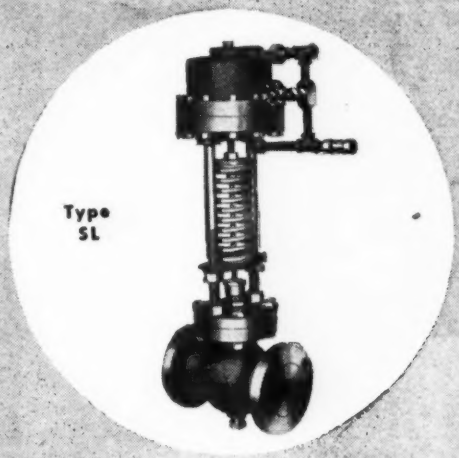
Every Copes Pump Governor is "tailored" to the specific application. This means not only selection of one of nine styles of inner valve fittings, but also design of the port area for existing flow and pressure conditions. Such individualized design results in maximum sensitivity of regulation and minimum wear.

High valve lift, close balance under flow conditions, and sturdiness are "plus" advantage that make Copes Pump Governors a sound investment.



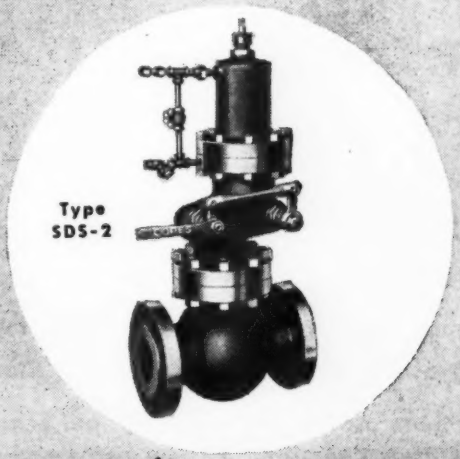
COPES *Type DS Governor*

Service—particularly suited to turbine driven pumps.
Controlled Excess or Constant Pressure Limits—10 to 75 psi.
Sizes—¾- to 4-inch, 250- and 300-lb. stds.
Special Features—Rotating stems, weight loaded, low cost.



COPES *Type SL Governor*

Service—particularly suited to reciprocating steam driven pumps.
Controlled Excess or Constant Pressure Limits—10 to 75 psi.
Sizes—¾- to 3-inch, 250-and 300-lb. stds.
Special Features—Large 4-ply bellows, tight seating inner valve, spring loaded, moderate cost.



COPES *Type SDS-2 Governor*

Service—for severe conditions with any type of pump.
Controlled Excess or Constant Pressure Limits—15 to 150 psi.
Sizes—1½- to 6-inch, 250-lb. std. and up.
Special Features—Rotating stems, large 4-ply bellows, spring loaded, unusually responsive.

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Feed Water Regulators • Pump Governors • Differential Valves
Liquid Level Controls • Reducing Valves and Desuperheaters

Branch Plants in Canada, England **Representatives Everywhere**

☆ *For* "TAILORED" PUMP GOVERNORS *specify*

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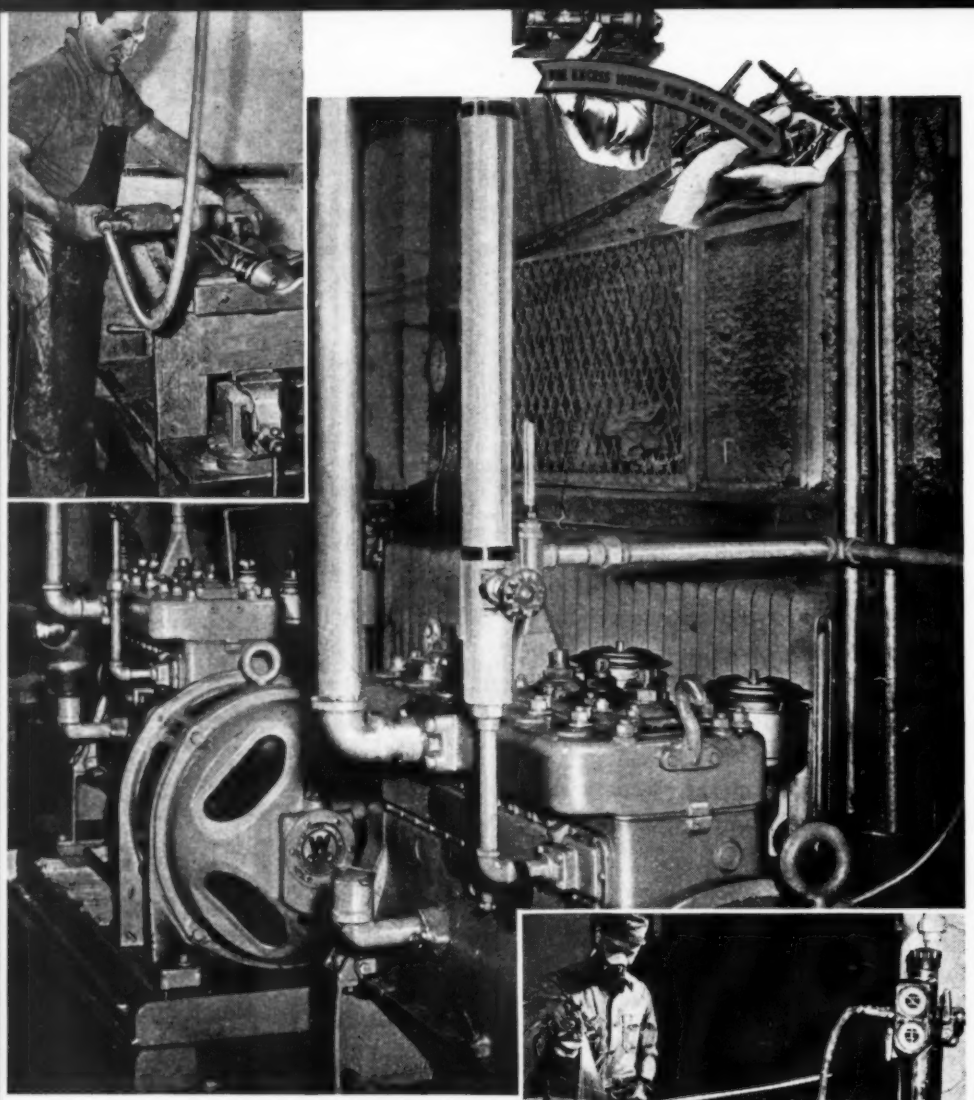


Here's An Air Compressor *for many uses*

This illustration shows a Schramm Air Compressor furnishing air for sanding and paint spraying airplane propellers.

Schramm stationary units fit the need for compressors that can do a variety of jobs in industrial and power plants.

Check these uses to which you can put Schramm in your plant: operating milling and drilling machines . . . chipping and calking hammers . . . cleaning engines and generators . . . sand blasting grooving bearings . . . cleaning boiler flues . . . and every other pneumatic tool requirement. Write today for latest bulletin.

SCHRAMM INC. THE COMPRESSOR PEOPLE WEST CHESTER PENNSYLVANIA

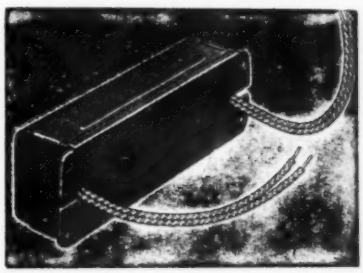
New Equipment

(*Continued from page* 130)

plant with same over-all dimensions and weight as gasoline engines of equivalent hp. It is a 4-cycle multiple-cylinder in-line trunk-piston engine, completely inclosed. *Sterling Engine Co, Buffalo, N. Y.*

Low-Pressure Gage

SENSITIVE TO ONE PART in 500 and accurate to one part in 300, new gage registers pressure exerted by a head of 0.02 in. of water. Backlash being eliminated, the action of sensitive series-connected beryllium copper capsules is transmitted to pointer with maximum accuracy. Gage covers a pressure range as low as 10 in. of water; 330 deg scale may be calibrated to meet any need. Also available are: (1) expanded scale at lower pressures and contracted one at higher (2) compound instrument measuring both vacuum and pressure (3) connections for ¼-in. pipe or ¼-in. hose. Static and pressure connections permit use as differential gage. *Wallace & Tiernan Products, Inc, Belleville, N. J.*



High-Voltage Ballast

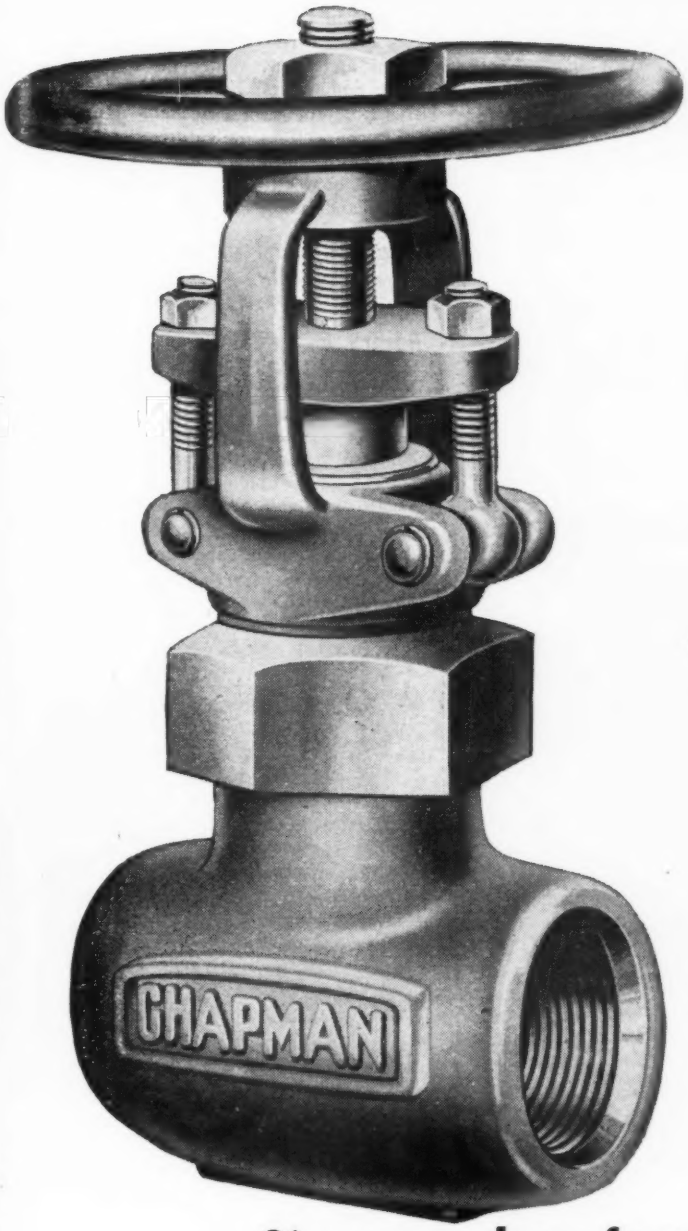
HIGH-VOLTAGE TULAMP BALLAST, for operation of new 40-watt instant-starting fluorescent lamps, applies 450 v to the lamp at starting, striking an arc between lamp cathodes, and thus eliminating need for separate starter equipment. Ballast is now available in Tulamp 40-watt ratings for 118-v circuits.

Ballast delivers rated watts to lamp at nominal circuit voltage. Uniform light output is said to be closely maintained even when circuit voltage varies within recommended operating range. Power losses are greater than in the conventional preheat ballast circuit.

Ballast has special filters for suppression of radio interference. Tulamp ballast is housed in a universal cast that allows leads to be brought out either at the end or the bottom. *General Electric Co, Schenectady, N. Y.*

Electrode Holder

HOLDER IS MADE in two identical models: *A* is a 19-ounce unit built to handle heavy 300 to 500-amp work, and *B*, a 6¼-ounce holder for lighter 200-amp jobs. It is molded of high heat-resistant plastic to insure full insulation and to eliminate possibility of arcing because of slag, moisture or contact



CHAPMAN'S

NEW!

LIST 960 GATE VALVE

Gives you these features . . .

Replacing Chapman standard List 960 small forged steel gate valve of the rising outside screw type, the new List 960 is designed for still greater strength and longer service. Specifically, here are a few outstanding features:

★ Bonnet now fitted with a substantial forged steel yoke. A flanged forged steel packing gland is provided, thereby eliminating exposed threading on valve yoke, thus giving immunity from rusting and corrosion when placed in exposed locations.

★ Stems, plugs, and seat rings *on all valves* are heat treated stainless steel to insure greater working qualities.

★ Swivel bolts are used for holding the packing gland.

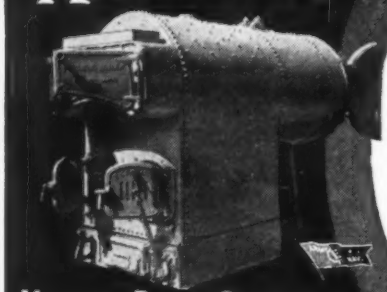
★ No gaskets to blow, as in valves with flanged bonnet connections.

Specify List 960 outside screw type in carbon steel for working pressures to 800 lbs. at 750° F. Or in alloy steel for service at 1000 lbs. working pressure at 750° F. Both valves available in screw and welding ends. Where service conditions make it preferable the List 960 rising stem inside screw type is available.

For greater pressures—get Chapman *List 990* with heavier walls and extra strength. In sizes up to and including 1½", with screw or welding end.

The Chapman Valve Mfg. Co., Indian Orchard, Mass.

EXTRA STRENGTH FOR HEAVY DUTY
KEWANEE



KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

Steel Plus Rivets

Steel plus Rivets further strengthened by extra stout stays and braces. Embodies all characteristics which make firebox type boilers especially adapted for high pressure.... 4 to 304 H. P. 100, 125, 150 lbs. W. P.

75 Years Boilermakers

Write Department 96-K9 for 6" scale with pipe diameter marking.

PYREX RED LINE
PYREX BROAD RED LINE
PYREX HIGH PRESSURE

One

OF THE COMPLETE LINE...
CORNING STANDARD

For use where Pressures are Moderate

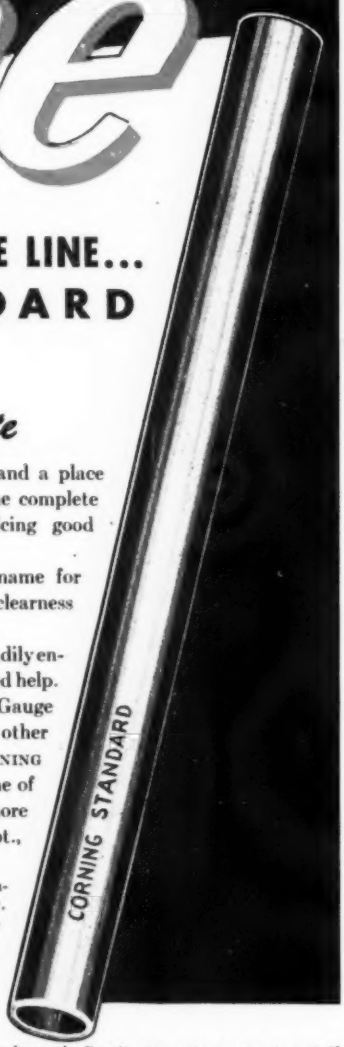
There's the spot for a CORNING Standard Gauge Glass and a place to save money too. By choosing this gauge glass from the complete CORNING Standard and PYREX Line you are practicing good judgment and economy.

The CORNING Standard Gauge Glass has earned a name for itself in moderate pressure service by its long lasting clearness and serviceability.

Its machine drawn accuracy means that you can more readily entrust its installation to your newest and most inexperienced help.

You're value-wise when you select CORNING Standard Gauge Glasses for those average pressure installations. To meet other operating conditions select the proper glass from the CORNING and PYREX complete line. You'll find that there is one of them to fulfill every different set of requirements. For more information write for Bulletin 817, Industrial Sales Dept., PO9, Corning Glass Works, Corning, N. Y.

PYREX brand High Pressure—resistant to thermal shock and mechanical shock and attack of steam and hot water. Machine drawn accuracy.
PYREX brand Red Line—Same but with added visibility afforded by enameled red line.
PYREX brand Broad Red Line—Same but with fused-in broad red line for extra visibility.
CORNING Standard—For moderate pressures. Long-lasting. Machine drawn accuracy



"PYREX" and "CORNING" are registered trade-marks and indicate manufacture by Corning Glass Works, Corning, N. Y.

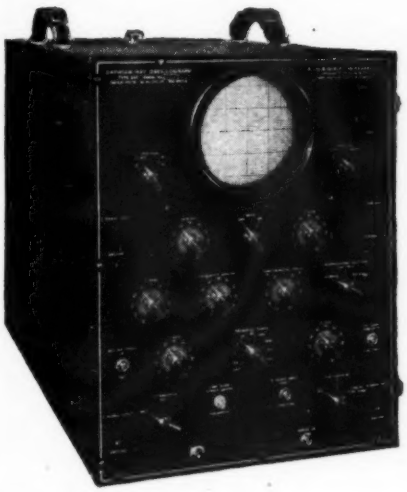
CORNING Glass Works Corning, New York

Pyrex Gauge Glasses

with grounded surfaces. Compactly constructed to reduce maintenance requirements and costs, holder incorporates only three main parts: handle, cable connector and tip. For either mechanical or solder cable connections, it features quick change and permits burning of electrodes to within ½ in. of holder tip. Left-hand threading in the tip and handle connection securely grips electrodes and prevents slipping. *Allison Tool & Engrg Co, 4031 Whittier Blvd, Los Angeles 23, Calif.*

Rotary Pump

BUILT IN ALL-IRON and bronze-fitted constructions, pumping unit is rated 50 and 90 gpm for discharge pressures to 500 psi. Standard motors with separate gear reduction or gearhead motors may be used. Units are also available for engine drive. While current production is entirely on the 50 and 90 gpm sizes, larger capacities will be available later. *Blackmer Pump Co, Grand Rapids 9, Mich.*

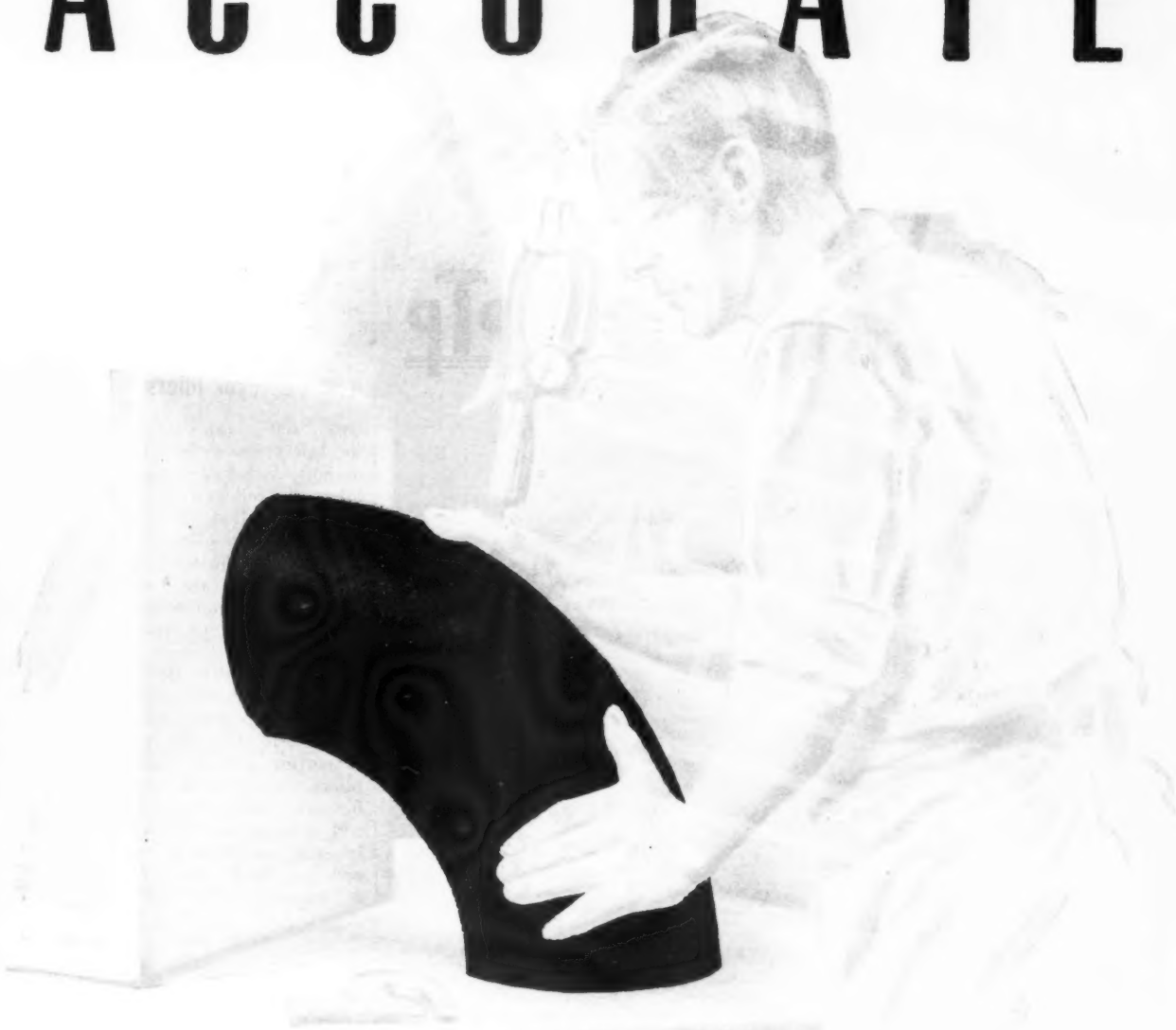


Oscillograph

DU MONT OSCILLOGRAPH, Type 247, facilitates recurrent and transient studies. Instrument utilizes the new Army-Navy 5CP1 cathode-ray tube with intensifier electrode, operating at an over-all accelerating potential of 3000 v. High-intensity patterns are obtained on the 5-in. diameter screen. Medium-persistence green screen is standard. For a permanent record of transient phenomena, instrument is supplied with short-persistence blue screen for high-speed photographic recording, or with long-persistence green screen for visual observation of low-speed phenomena.

Sweep frequency range has been extended down to one-half cycle per second, providing a wider range of sweep operation. Thus it is used for observations on low-speed machinery and for other low-frequency functions. The time-base provides recurrent, single or repetitive sweep operation. An unusual beam-control circuit is used with single sweep operation, to darken the screen except during actual sweep cycle, providing a reduction of background illumination and resulting in photographs of greater contrast. Instrument features uniform response over a wide frequency range for both vertical and hori-

ACCURATE



Check . . . recheck . . . check again! Nothing left to chance. From raw materials to finished product, every step of the way, each Tube-Turn welding fitting is subjected to many routine inspections that are designed to insure accurate dimensions and conformity to American standards.

Bevels, inside and outside diameters, interior surfaces, wall thickness, finish, all must meet Tube Turns' standards of accuracy. Small wonder that Tube-Turn welding fittings help to make piping systems lower in upkeep costs, and more efficient. Write for Catalog 111 — now!

If you don't have one, write today for the new booklet "Allowable Working Pressures."

Selected Tube Turns Distributors in every principal city are ready to serve you from complete stocks.

TUBE TURNS (Inc.) Louisville, Kentucky. Branch Offices: New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, San Francisco, Seattle, Los Angeles.

TUBE-TURN

TRADE MARK

Welding Fittings and Flanges

INTESTINES with Fortitude!

PTP

Seamless steel tubes are the intestines of the ship, the power plant, the oil refinery, the locomotive, and the chemical plant...delivering an ever-flowing flood of power to America's mighty production efforts.

Seamless steel tube "know-how" is vitally necessary to keep those lines going steadily. Cold drawn seamless steel PTP tubing achieves accuracy to size and uniformity of gauge through exacting control and thorough inspection at every step in manufacture. Where cost is a factor, and seamless steel tubing required, PTP tubing offers an economical and satisfactory solution to the problem.

★ Official United States Navy photograph. Interior of a submarine —a maze of piping.

PIPE & TUBE PRODUCTS
INCORPORATED
Manufacturers of Cold Drawn Seamless Steel Tubing
JERSEY CITY, N. J. • WORKS: READING, PA.

zontal axes, a distortionless continuously variable low-impedance attenuator or gain control and a Z amplifier channel for applying external timing signal to grid of modulating electrode. *Allen B Du Mont Laboratories, 2 Main Ave, Passaic, N. J.*

Fungicidal Concentrate

COMPOUND CAN BE USED in various insulation and sealing waxes. Manufacturer claims it does not precipitate upon cooling, proves effective in the wax compound, does not reduce insulation properties nor volatilize or lose potency at bath temperatures. An *Insl-x* toxicant, it is nontoxic to humans and does not cause dermatitis. *Insl-x Co, 857 Meeker Ave, Brooklyn, N. Y.*

Belt Conveyor Idlers

THE "100" LINK-BELT antifriction idlers for belt conveyors are available in several designs, including: troughed carrying-run idlers, flat-roll carrying and return idlers, troughed self-aligning idlers and self-aligning return idlers.

Features of the new "100" idlers include: (1) Positive grease seal keeps grease in and dirt out of antifriction bearings. (2) Troughing rolls are accurately aligned in a streamlined steel frame assembled in jigs for correct bracket spacing and roll interchangeability. (3) Roll shafts lock in frame, yet are quickly and easily removed. (4) Interlocking nuts and yokes keep roll supporting brackets from spreading. (5) Idlers are equipped with pipe extensions for safe center-roll lubrication from one end of troughing idler unit. (6) All rolls in each troughing idler are same length and interchangeable. *Link-Belt Co, 307 N. Michigan Ave, Chicago, Ill.*

Midget Transformer

ACME TRANSFORMER, in an aluminum case, is 1 in. in diameter and $1\frac{7}{16}$ in. in height overall. Weight is approximately 2 oz. Midget transformer is for certain electronic applications and is rated at 1.4 henries at .025 amperes dc, with 100 ohms resistance value. *Acme Electric & Mfg Co, Cuba N. Y.*

Hose Clamp

AVAILABLE FROM $\frac{3}{4}$ to 48 in. ID for banding clamping or splicing all hose from the modern high-pressure wire-woven and braided kind used in control of hydraulic machines to ordinary air and water hose. To connect, a broad flat high-tensile-strength galvanized-steel band is double-

NUMBER FOUR OF A SERIES ON VALVE SELECTION

Protect equipment against abnormal pressure increases *with* Edward RELIEF VALVES

WHETHER for power, marine, chemical process, petroleum, refining, hydraulic or general industrial services, the most important consideration in selecting relief valves is *absolute dependability.*

Edward relief valves protect expensive equipment against sudden and unusual pressure increases in all kinds of services. Functional design, with only a few parts all built to extraordinarily high precision standards, and production-run quantities make Edward relief valves surprisingly low in initial cost and exceptionally economical over the long pull.

Since every valve is factory set for the required relieving pressure, inquiries should include information concerning service, frequency of operation, and relieving pressure.

Regularly available in ¼ in. to 2 in. sizes inclusive.

Look for These IMPORTANT POINTS

BODY
Drop forged heat treated steel. Distribution of metal around body flow areas equalized so that in heating and cooling there is negligible distortion.

BONNET
Rolled carbon steel, with body and locknut joints carefully ground for tight fit.

BEARING PLUG
Hardened stainless steel. Point contact always permits disk to reseat promptly and tightly.

BALL DISK
Hardened corrosion resistant stainless steel, accurately ground for tight seating.

SPRING
Fine carbon or stainless steel spring, adequate length for full area when discharging. Design of adjusting mechanism makes possible close pressure regulation.

SEAT
Renewable EValloy stainless steel, with sturdy shoulder and full threads engaging body.

FIG. 141

Is Edward BETTER VALVES *Catalog 102 in your files? If not, write for your copy today.*

THE EDWARD VALVE & MFG. CO., INC. • EAST CHICAGO, INDIANA

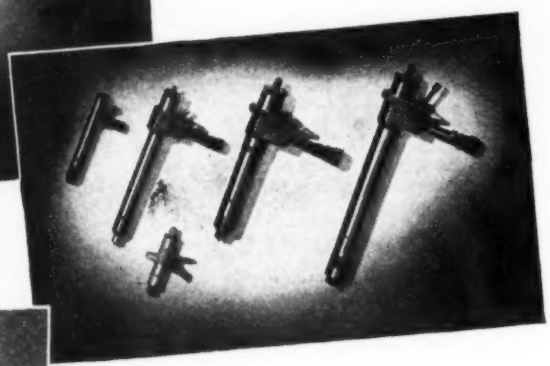
EDWARD *Steel* VALVES

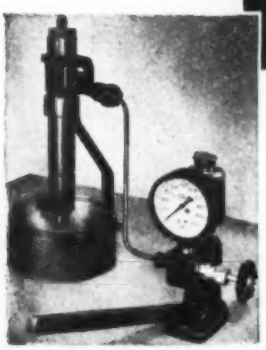
SAFEGUARD DIESEL ENGINE PERFORMANCE

with Dependable ADECO

FUEL INJECTION EQUIPMENT

Adeco equipment is engineered to secure the optimum performance of the engine you are building or plan to build. Today's line of fuel injection pumps, nozzles and nozzle holders is the most dependable in Adeco history—the result of years of pioneering and research for the diesel industry. Their performance speaks louder than words in pointing the way to the finest in diesel fuel injection equipment.





ADECO NOZZLE TESTER for LOW-COST MAINTENANCE

America's most widely used Nozzle Tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors. Avoids costly delays and possible damage to engine. Also obtainable with Navy-approved gauge. Write for bulletin.

Ideal for Testing Hydraulic Equipment

ADECO

AIRCRAFT & DIESEL EQUIPMENT CORPORATION

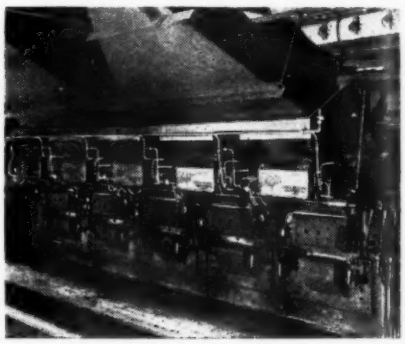
4401 RAVENSWOOD AVENUE, CHICAGO 40, ILLINOIS

wrapped around joint. After tensioning with a pull of 1000 lb within the *Loking* tool, ends are securely locked together under tension, within the flat pressed-steel clip and the excess band cut off flush with the clip to streamline entire joint for safety.

For electrical applications, *Punch-Lok* clamps may be obtained in *Everdur*, a copper-base alloy for corrosion resistance; and in both preformed and open-end types, the latter for lacing around the object where end obstructions would prevent use of preformed clamp. *Punch-Lok Co, 321 N Justine St, Chicago 7, Ill.*

Lubricating Systems

FOUR CENTRALIZED lubricating systems are for small, medium and large heavy-duty machinery, as well as for large batteries of machinery where it is desirable to lubricate hundreds of bearings from a central point.



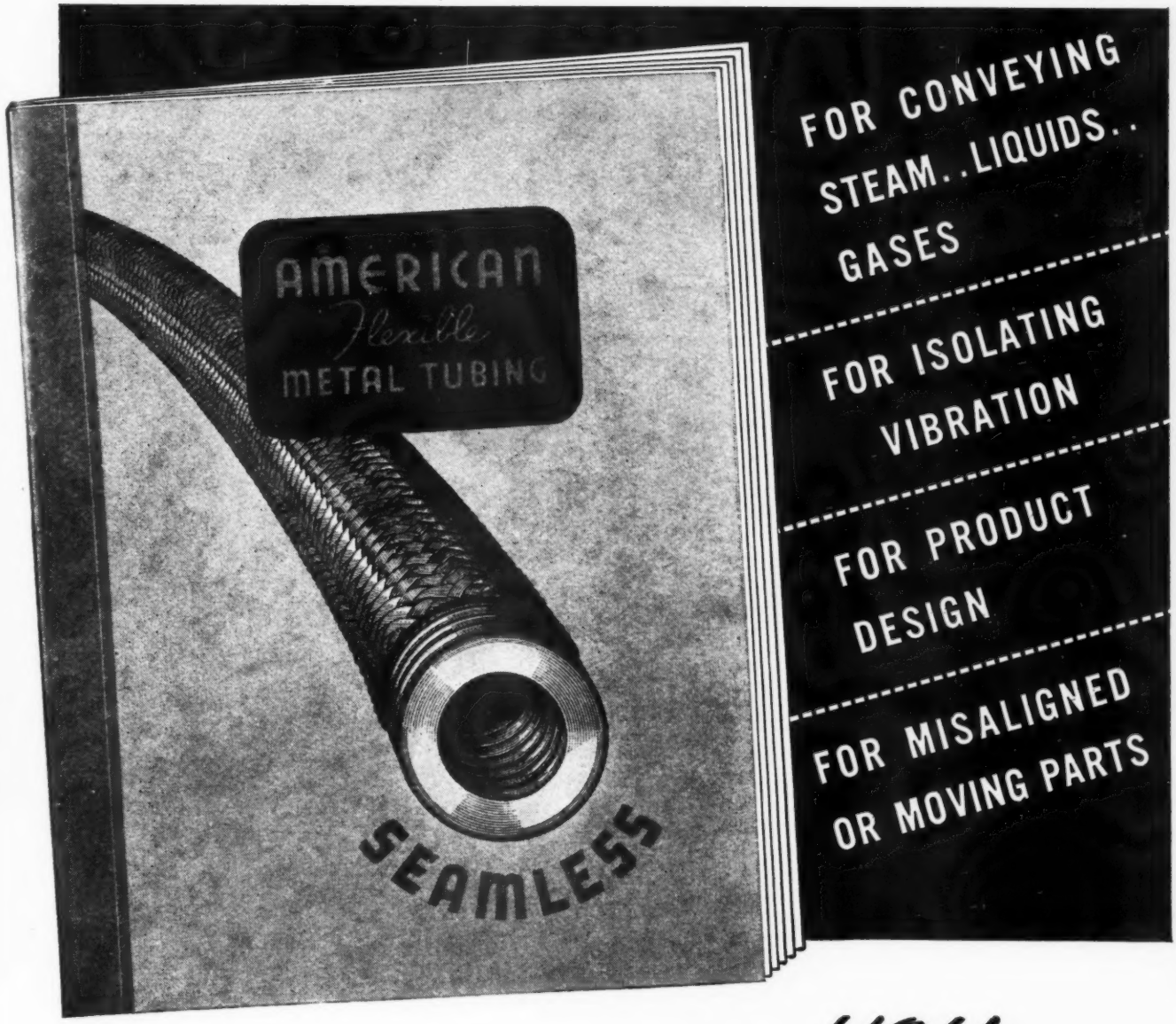
Alemite LubroMeter, illustrated, simplest form for ease and economy of installation, has only two moving parts in its valves and handles both oil and grease. It may be used over a wide range of temperatures. Lubrication is through individual valves at each bearing connected to a single lubricant supply line. Valves supply bearings with an adjustable predetermined amount of lubricant.

Alemite Dual Progressive System provides positive delivery of a predetermined amount of lubricant through a single pipeline to bearings and has an indicator which signals when lubrication cycle is completed. Each bearing is fully lubricated before the next in line is serviced.

Lubricant under pressure may be introduced to system by either portable or stationary hand guns or power-driven pumps. Compact dual-action feeder valves, which are fully hydraulically actuated, deliver a measured quantity of lubricant to two bearings. These feeder valves are available in seven sizes. System functions under extreme heat or cold.

Alemite Progressive System lubricates from 3 to 20 bearings, feeding each in turn with a predetermined amount of lubricant. This multiple-line system may be mounted on a machine anywhere, and tubing, run from each of the outlets, conducts lubricant to its respective bearing. System may be served from hand or power-operated portable grease guns.

Alemite Dual Manifold System is a dual-line system of centralized lubrication for high-pressure grease or oil lubrication. It is a simple, direct hydraulic system which permits introducing a fully adjustable pre-



There is a Chapter for *YOU...*

in This New Booklet on American Seamless Flexible Tubing

JUST PUBLISHED, this story of American Seamless Flexible Metal Tubing is something you'll want to read and keep for reference. It contains valuable information for every manufacturer, engineer and machine designer.

How American Seamless is made, the jobs it can do—from the conveying of steam under pressure to the joining of misaligned or moving parts—this 40-page booklet covers flexible tubing requirements in the industrial field. There are many illustrations in color to show the great diversity of services in which American Seamless has proved itself to be the most dependable flexible connector obtainable.

A copy of this booklet, Bulletin No. SS-50, is ready for you. Write to AMERICAN METAL HOSE BRANCH of The American Brass Company, Waterbury 88, Connecticut.

ANACONDA

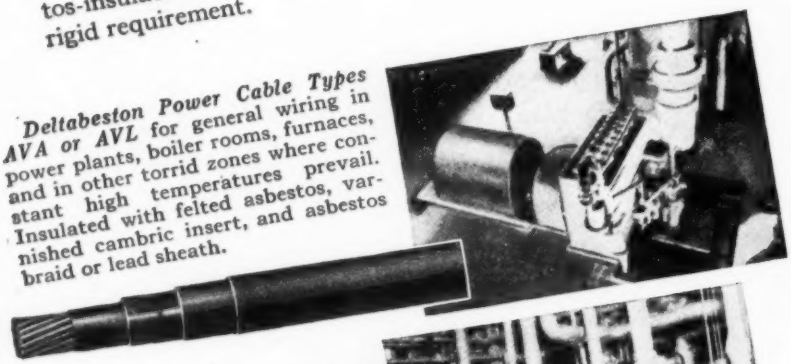
American Metal Hose

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY • General Offices: Waterbury 88, Conn.
Subsidiary of Anaconda Copper Mining Company • *In Canada:* ANACONDA AMERICAN BRASS LTD., *New Toronto, Ontario*

FOR WIRING IN TORRID ZONES rely on Deltabeston Cables

There's no better way to avoid frequent rewiring jobs in torrid zones than protecting with Deltabeston Asbestos-insulated Cables. That's why Deltabeston is used extensively on power, lighting, and control circuits where severe operating conditions exist. Power engineers don't take chances with ordinary cables. They rely on Deltabeston because it's designed to resist intense heat, high moisture, and most corrosive vapors.

Here are only a few of the complete line of Deltabeston Asbestos-insulated Wires and Cables. There's a type to meet your most rigid requirement.



Deltabeston Power Cable Types AVA or AVL for general wiring in power plants, boiler rooms, furnaces, and in other torrid zones where constant high temperatures prevail. Insulated with felted asbestos, varnished cambric insert, and asbestos braid or lead sheath.

Deltabeston Boiler Room Wire Type AVA for wiring in boiler rooms, central stations, steel mills, and other "hot spot" installations. Insulated with felted asbestos, varnished cambric, and asbestos braid.

Deltabeston Apparatus or Motor Lead Wire Type AVA for wiring apparatus in power plants, steel mills, boiler rooms—installations where flexibility in excessive heat conditions is desired. Insulated with felted asbestos, varnished cambric and asbestos braid.

BUY WAR BONDS AND KEEP THEM

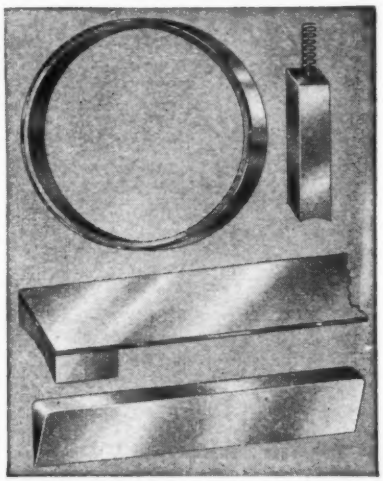
Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

For additional information write to Section Y943-52, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn. Deltabeston Wires and Cables are distributed nationally by Graybar Electric Co., G-E Supply Corp., and other G-E Merchandise Distributors.

GENERAL ELECTRIC

determined charge of grease or oil, at any temperature, into all bearings of a machine. Heavy-duty construction is particularly adapted to heavy equipment, batteries of machines and outdoor installations.

Dual manifold valves have two, six, eight or ten outlets. System features Alemite Model 7040 stationary hand-operated pump for permanent mounting on machines. *Alemite industrial lubrication div, Stewart-Warner Corp, 1826 Diversey Parkway, Chicago, Ill.*



Current Collectors

VARIOUS CURRENT COLLECTOR DEVICES are of silver and silver alloys. Gibson has developed means of producing small and intricate commutator segments of various shapes for numerous applications. They are made within very close tolerances. Maximum hardness and wearing qualities of both silver and silver alloys are maintained. Commutator bar, collector ring, motor brush and sliding contact (all illustrated) are a few parts now being produced for special applications where copper and other base metals are unsuited. *Gibson Electric Co, 8365 Frankstown Ave, Pittsburgh 21, Pa.*

Reclaiming and Salvaging Equipment

COMPLETE INSTALLATION for reclaiming defective aluminum castings, salvaging bronze, gray iron, malleable and steel castings, as well as building up surfaces for press fits, repair of cracked housings, motor blocks and pump housings and preparation of surfaces for metallizing, includes a *Mogul Nervous Weld* pistol and a *Mogul Nervous Weld machine.* For manual operation, pistol deposits atomized metal particles, which are welded to the surface and pressed, leaving metal welded and forged. *Metallizing Co of America, 1330 W Congress St, Chicago 7, Ill.*

Steel Safety Mats

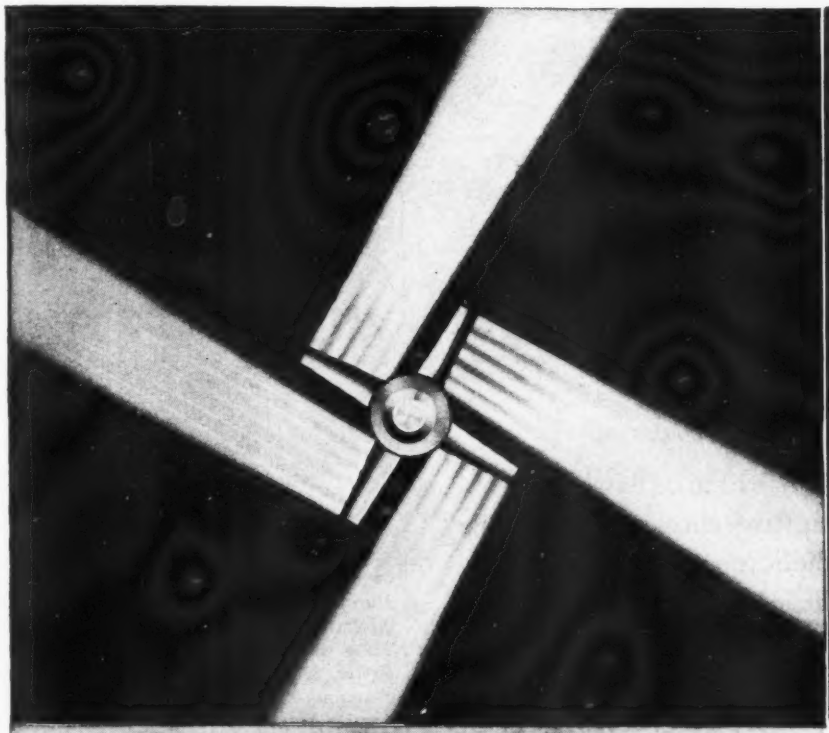
FOR NON-SKID PROTECTION a new feature has been included: a slight crimp or center bend in one side of the steel mesh. These mats roll up like rugs and are made to 25-ft length and 6-ft width. Any area can be covered by joining multiples. Mats pre-

"Pinwheel Action" is the principle of a revolutionary gas burner that uses the energy in gas under pressure to do the work of correctly proportioning gas and air and provide greater heat release.

With the Coppus-Dennis FANMIX Gas Burner, complete combustion with less than 5% excess air is guaranteed! For example, with natural gas of 1,000 B. T. U. per cubic foot, flue gas analysis of over 11% CO_2, a fraction of 1% of O_2, and no CO—is not unusual.

FANMIX gives you truly radiant heat—a high, even furnace temperature. There are no drifting "hot spots"—no secondary combustion to deteriorate furnace lining.

Let us tell you more about increasing ratings with Coppus-Dennis FANMIX. Send for free booklet 410-3.



EXCLUSIVE FANMIX PRINCIPLE

Gas under pressure, escaping from radially-spaced orifices in the driving arms, rotates the fan, causing intake of air at right angles to the path of the gas. The number of orifices, as well as the gas pressure, determines the gas flow. The reaction force determines the speed of rotation, hence the air delivery. Gas and air are thus mechanically mixed — thoroughly and in automatically correct proportions for complete combustion; without impingement.

When planning new boiler installations, you can save on:

1 ***combustion space.*** With FANMIX the furnace does not have to serve as a mixing chamber.

2 ***stack height.*** With FANMIX there is no draft loss across the burner.

3 ***installation costs.*** With FANMIX you can use smaller pipe sizes, you need no forced draft equipment., etc.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

DESIGNED FOR YOUR INDUSTRY—ENGINEERED FOR YOU

FREE BULLETIN FOR OPERATORS OF GAS-FIRED EQUIPMENT

Coppus Engineering Corp.
519 Park Ave., Worcester 2, Mass.

Please send Bulletin 410-3 to

Name .....

Company .....

Address .....

MATCH FOR VOLCANIC *temperatures*

The above fabrications are chrome nickel. Only a small fraction of this 18-8, 25-12 job, they will conduct certain elements at extremely high temperatures.

Speed was required on this work. Yet when finished the work had to be flawless—as exhaustive checks proved. The implications that accompany the placing of such orders profoundly qualify the ability of Associated in the field of industrial piping. Let this firm assist with your fabrication problems.

ASSOCIATED PIPING & ENGINEERING CO., Inc.
2332 East 38th Street • Los Angeles 11, California

ASSOCIATED *Progressive* **PIPING**

vent slipping and falls, keep feet dry and make lifting safe. Made of steel, nonabsorbent, easily cleaned in hot water. *Wm F Klemp Co, 6641 S Melvina Ave, Chicago, 38, Ill.*

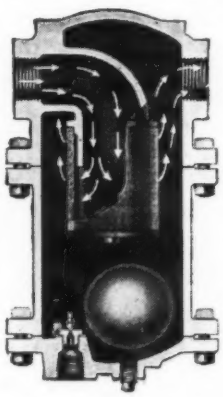
Drum Indicator

IN ADDITION to fitting 55-gal steel drums, U-C indicator is for 30-gal drums. U-C tells at a glance liquid-level content of drums containing oil, solvents, etc. Indicator eliminates tapping, measuring, guessing and keeps constant check on fluid supply. For easy transfer, screw indicator into drum faucet opening, then screw faucet into opening on indicator body. When drum is empty, remove entire assembly and attach to a full drum. *Techtmann Industries, Inc, 828 N Broadway, Milwaukee, Wis.*

Compressed-Air Separator

JOHNSON SA self-draining compressed air separator eliminates external traps or manual draining. It has a complete built-in trap mechanism, which automatically releases from separator all water, oil and other moisture removed from the compressed air.

Operation is identical with that of Standard Johnson separators. It employs the principles of expansion and change of direction, a combination which,



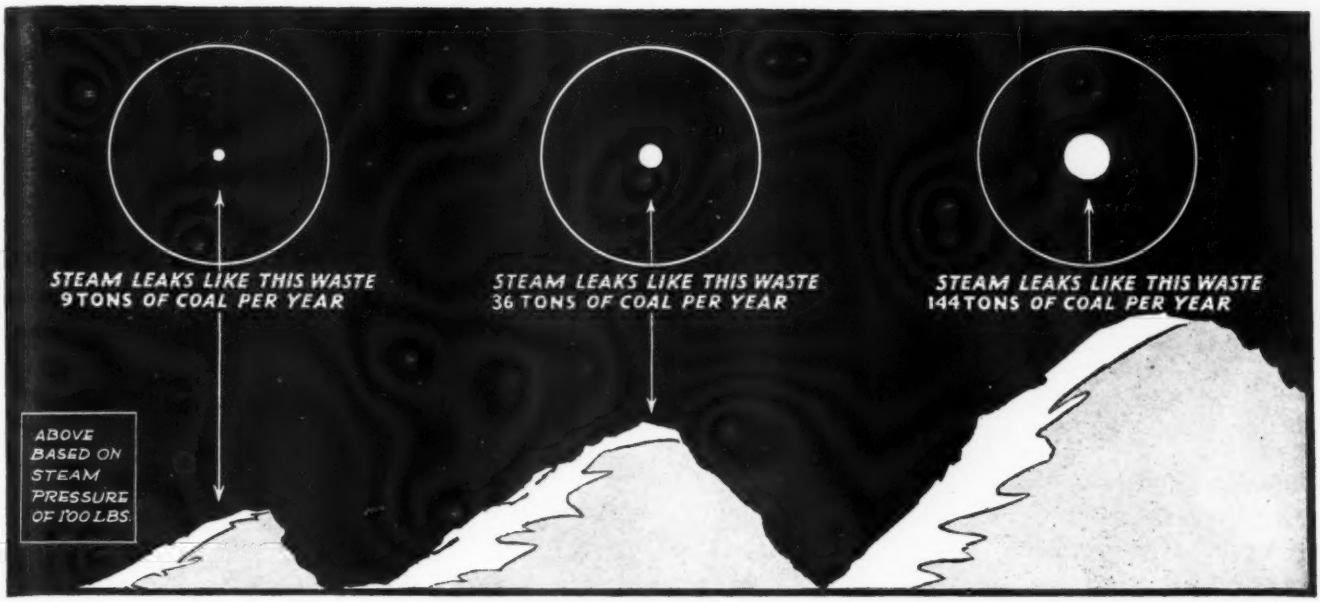
according to maker, achieves an efficiency of more than 99%. Entering air is first allowed to expand slightly, thereby precipitating most of the entrained moisture. Then it passes through the *thousand baffles*, a labyrinth of coarse wire mesh, changing flow direction many times and surrendering remaining foreign particles.

SA compressed air separator is available with capacities of 80 or 160 cu ft of free air per min at 90 psi. Smaller size has inlets of ¾, 1 or 1¼ in.; the larger has inlets of 1½ or 2 in. *Johnson Corp, Three Rivers, Mich.*

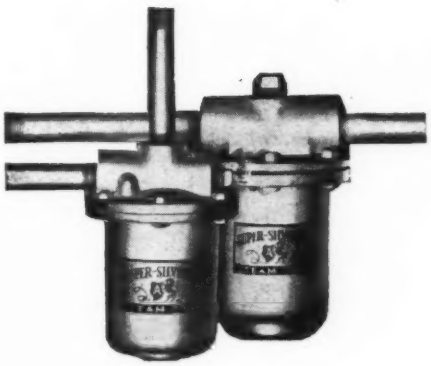
Coal Feed Agitator

UNIFORM COAL FEEDING in multiple retort underfeed stokers is now assured by a new agitating device incorporated in the latest type *Taylor* stokers, according to the manufacturer. Bridging of coal in the stoker hopper, especially in the winter when the coal supply is wet or partially frozen, is eliminated by the agitator's reciprocating

Speaking of FUEL CONSERVATION...


STEAM LEAKS LIKE THIS WASTE
9 TONS OF COAL PER YEAR
STEAM LEAKS LIKE THIS WASTE
36 TONS OF COAL PER YEAR
STEAM LEAKS LIKE THIS WASTE
144 TONS OF COAL PER YEAR
ABOVE BASED ON STEAM PRESSURE OF 100 LBS.

have you checked your steam traps lately?



This photograph shows how Super-Silvertop Steam Traps can be piped straight-in-line or as an elbow, requiring the use of only one fitting instead of seven, and taking less installation time. Super-Silvertops can be inspected without removing from the line.

The National Fuel Efficiency Section of the Bureau of Mines is asking us to conserve fuel in all its applications. Fuel is needed to win the war . . . there must be no waste!

The above chart shows one way a tremendous amount of fuel is wasted — LEAKS! Some leaks are from old, obsolete steam traps, traps with scored valves, worn parts, improper alignment of valve and seat, etc.

Right now, before winter sets in, have a thorough inspection of your traps . . . see that they are clean, that no parts are worn, that all parts are in alignment. If you need a new trap, get an ANDERSON SUPER-SILVERTOP . . . these traps save fuel, will not airbind, are self-venting, self-screening and have a large capacity for their size, can be installed as an elbow or straight-in-line.

Send today for the book, "How to Choose a Steam Trap", which gives complete information.

THE V. D. ANDERSON COMPANY
1934 West 96th Street • Cleveland, Ohio

ANDERSON SUPER-SILVERTOP STEAM TRAPS

DART UNIONS

Cost Less Per Year

The union that costs least is the one that gives most in service. That's why Darts are the choice of veteran buyers.

Built with two bronze seats, which are ground to a true ball joint, they become in use practically one-piece units. Yet, they dismember in a jiffy—unscarred, and ready again for service wherever a leakproof coupling is needed.

Bodies and nuts are of high-test air-refined malleable iron—practically unbreakable.

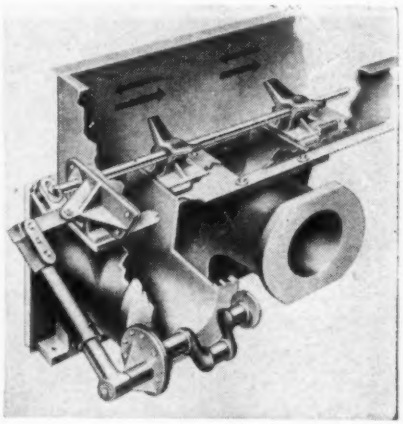
Next time you change piping, change to Darts. Your supplier will be glad to show you what a difference there is.

DART UNIONS

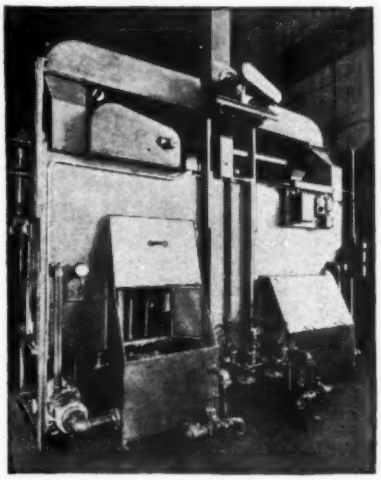
DART UNIONS LIVE LONGER

E. M. DART MFG. CO., Providence, R. I.

motion across the stoker width between retorts. This also prevents bridging across the hopper lengthwise of the stoker, by breaking the support of the arch formed when coal flow is interrupted.



Power for the agitator is provided by the stoker's all-spur gear planetary transmission. A shearing pin provides protection against tramp iron or other obstructions in the coal. Oil-impregnated bushings need no lubrication. The agitator, in contributing to uniform fuel bed conditions, is said to be an important factor in raising capacity of the generating unit with greater efficiency and less maintenance. *American Engineering Co, Philadelphia 25, Pa.*

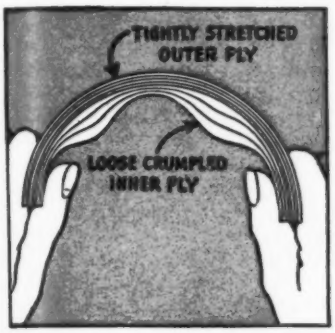


Metal Washer

MONORAIL-SPRAY WASHER handles metal parts such as intricate circular parts or those with many ports, crevices or openings, which must be rotated while passing through the cleaning chamber. Unit can be equipped for heating with steam, gas coils or electric immersion heaters. Thermostatic controls are furnished and a ventilation ductwork provided to carry away steam and vapors. *Metal washing machine div, American Foundry Equipment Co, 555 Byrkit St, Mishawaka, Ind.*

Alkali Cleaner

FOR CLEANING electrical high-tension wire insulators, *Nielco* 1931-T is of low sodium-oxide content, free flowing and soluble in tepid water. Does not injure the hands,



Try this yourself to illustrate what happens when your belts lack Compensation. A pad of paper, held firmly and bent, has buckling sheets on the inside of the curve. This shows lack of equal tensions and illustrates why the plies of conventional belt "bootleg."

–with its fatigue-relieving Strength Members–
gives you longer belt life, more power at the Point of Production

The Compensation Principle makes every ply work under equal stress—and prolongs the life of belts made from today's synthetic rubbers. You no longer need penalize your production by constant alternating of "stretch and buckle" stresses which, in ordinary belt, cause ply rupture as the belt goes round the pulley. Look at the diagram below which illustrates the difference between ordinary belt and Compensated Belt behavior under curve load. Note how Compensation—a patented and exclusive MANHATTAN development—*equalizes ply stresses*, prevents these destructive alternations of "stretch and buckle." Note how smoothly and uniformly the Compensated plies flex around the curve—providing fatigue relief for "war" rubber.

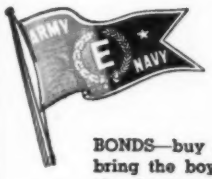
The amazing service you get is the result of MANHATTAN'S specially designed Strength Members so laid in FLEXLASTICS* that you get a truly Compensated Construction—flexible, longer-lived, with high overload capacity and capable of running over smaller pulleys without danger of ply separation or rupture of outside plies.

This principle of Compensation was developed for Condor Compensated Transmission Belt but is now also incorporated in MANHATTAN Conveyor Belts to increase service life where small end pulleys are used.

Users report 3 to 4 times longer fastener life. A paper mill reports a 9-year-old Compensated Belt "still performing like new." "100% more starting load capacity without appreciable belt slip," is still another comment.

Compensate yourself three ways—safeguard production, get longer belt life, increase power transmission efficiency with this revolutionary Compensation Principle in MANHATTAN Belts.

The term FLEXLASTICS is a MANHATTAN Trade Mark. Only MANHATTAN can make FLEXLASTICS.



BONDS—buy more to bring the boys down the home stretch.

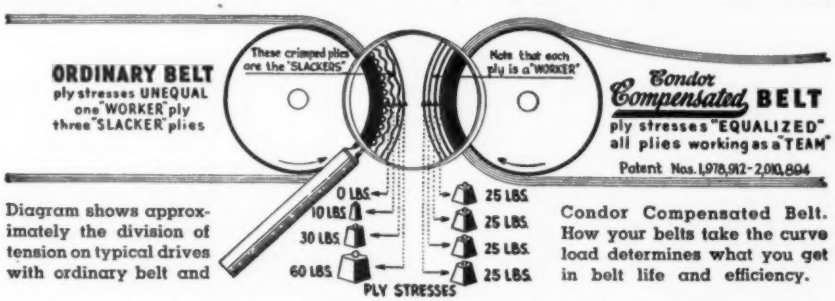


Diagram shows approximately the division of tension on typical drives with ordinary belt and Condor Compensated Belt. How your belts take the curve load determines what you get in belt life and efficiency.

KEEP AHEAD WITH

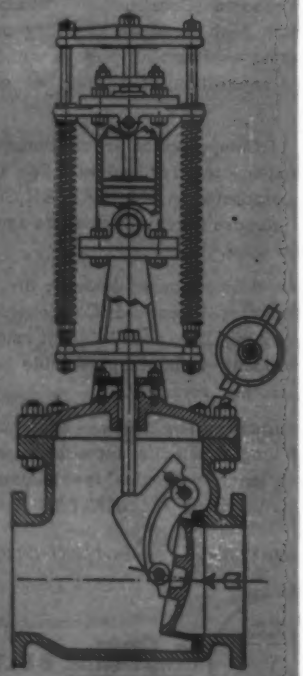
MANHATTAN

THE MANHATTAN RUBBER MANUFACTURING DIVISION
OF RAYBESTOS-MANHATTAN, INC.
EXECUTIVE OFFICES PASSAIC, NEW JERSEY

Quick, Positive Action

TURBINE BLEEDER LINE NON-RETURN VALVES

- Maximum Safety
- Sensitive Operation
- Unrestricted Flow



Straight flow type, turbine bleeder non-return valve with oil control cylinder mounted above valve.

The counterbalanced swing check type is the simplest Davis Non-Return Valve and provides full port opening with very slight resistance to flow. By accurately setting counterbalance weight, the valve may be made very sensitive so that it closes immediately when direction of flow is reversed. The outside counterweight lever gives visible action and affords ready means for hand testing. An oil dash pot may be provided for cushioning the valve action when desirable.

Other Davis Non-Return Valves are available with auxiliary oil cylinders to close valve on failure of oil pressure.

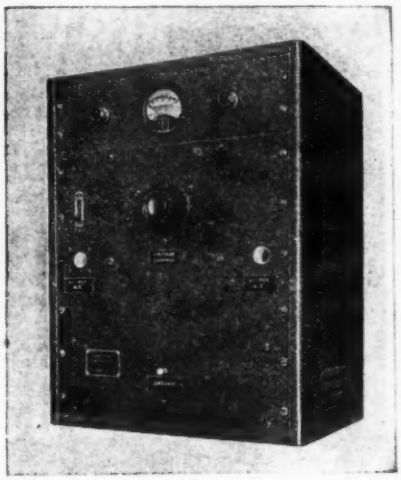
Standard sizes from 4" to 24". For any pressure. Write today for literature and recommendations.

DAVIS REGULATOR COMPANY
2540 S. Washtenaw Ave.
Chicago 8, Ill.

DAVIS VALVES

DAVIS REGULATOR COMPANY

gives off no harmful caustic vapors at boiling temperatures and does not injure porcelain finish. *Nielco Laboratories, 19720 Florence Rd, Detroit 19, Mich.*



Voltage-Breakdown Tester

TYPE P-3 has an operating range of 0 to 10,000 v dc or 0 to 8000 ac. Type P-1, with sloping panel, has a range of 0 to 4000 v dc or 0 to 3000 ac. Voltage is continuously variable over entire range. Tester operates directly from 110-130-v 50/60-cycle ac line. Breakdown is indicated by a red signal while built-in meter indicates direct-reading voltage. *Industrial Instruments, Inc, 17 Pollock Ave, Jersey City 5, N. J.*

Safety Goggles

A SMALL-SIZED EYECUP SAFETY GOGGLE, for women workers whose eyes are exposed to the hazards of flying objects, has clear, flat Super Armorplate lenses, in 44.6 mm eye size. It has an insulated ballchain bridge, which can be adjusted easily and quickly. Headband is also adjustable. *American Optical Co, Southbridge, Mass.*

Speed Reducer

AIRKOOLED WORM GEAR speed reducer offers greater horsepower ratings than standard heavy duty units for speeds of 580 to 1750 rpm. At 1750 rpm ratings are approximately double at all ratios. Unit dissipates heat,

(*Continued on page* 160)

Peacetime efficiency in war production . . . how some industries have achieved it

AT NO TIME in history have industrial men worked closer with suppliers and with each other than during the period of conversion to all-out production for war.

In no field has this cooperativeness been more productive in adding to machine efficiency, saving scarce equipment, and in reducing waste than in lubrication. Through the efforts of industrial management, many maintenance problems were brought to light which Standard Oil Lubrication Engineers and plant men were able to solve to the benefit of all.

The following examples may suggest ways in which cooperation with the Standard Oil Lubrication Engineer will bring worthwhile savings to your plant in materials, maintenance, and productive labor.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

PLEASE TURN THE PAGE FOR DETAILS

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICAT

• • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRI

Lubrication *News* letter

Practical suggestions from the field on how Lubrication Engineering and lubricants are being used by midwest operators to lick tough wartime jobs. **SEPTEMBER, 1944**

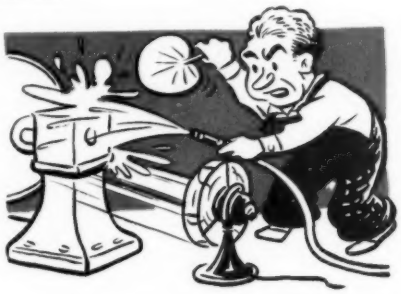
Continuous operation under heavy loads of turbine generating equipment to meet wartime needs has brought home to many operators the importance of a turbine oil that does not sludge turbines—that never needs changing or treating—and is guaranteed to stay free from harmful acidity for the "life of the turbine." That is—Nonpareil Turbine Oil.

In a middle western industrial power plant three turbines had operated eight years on Nonpareil Turbine Oil without any sludge trouble, turbine cleaning, or oil treating. Then, as a test, one turbine was filled with a conventional turbine oil. Trouble began popping. Bearing temperature rose, oil screen clogged and oil was centrifuged continuously. To make sure the trouble wasn't a mechanical difficulty, Nonpareil was replaced by a conventional oil in *another* turbine. Deposit trouble switched to this turbine. Meanwhile the one turbine still on the eight-year-old fill of Nonpareil gave no trouble. All three turbines are back on Nonpareil—to stay.

Knocks the peaks off of power demands. A St. Louis company saved enough on power bills to pay the lubricating costs on two crushers—and then some. A simple change in lubrication did the trick.

The company's power bills were based on a high demand load. An analysis showed that two crushers were the principal cause. They were operated in an exposed location. Starting them in even moderately cold weather shot power demands sky high. A Standard Lubrication Engineer recommended two grades of Stanoil—one for summer and one for winter. Reduced starting loads in winter cut the high demand load enough to make a substantial reduction in the plant electric power bill.

Unusual conditions required the *two* grades of Stanoil. Usually the high viscosity index of Stanoil makes it possible to use only one grade the year 'round on motors, reduction gears, and other equipment operating in exposed locations.

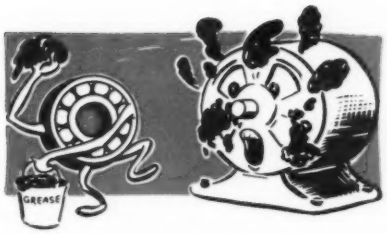


Eliminate need for cooling line to mill bearings. Open cellar, grease lubricated bearings on a large ball mill in a Missouri plant ran dangerously hot. The first remedy tried was expensive. Air and water lines were run to the bearings. This helped to reduce temperatures somewhat. The second attempt was simple. A Standard Lubrication Engineer was called in. He suggested a test of Stanolind Mill Grease. In the first 10 hour test, bearings ran cooler. After two days it was evident that the cooling line would not be needed. Bearing temperatures dropped 45°—to 115° F.—and stayed there, with Stanolind Mill Grease as a lubricant and no special cooling.

Compressor fire hazard reduced. Excess oil in the receiver of multi-stage compressors can be dangerous. When heavy loads, long hours of operation, or faulty cooling units allow operating temperatures to rise, it presents a definite fire hazard.

A Michigan plant found this out the hard way—by experience. After one or two "experiences," which left no doubt something had to be done, the Standard Lubrication Engineer was called in. He made three suggestions: (1) Lower intake air temperatures. (2) Lower cooling water temperatures in the after-cooler. This condenses oil vapor before it is carried over into the receiver. (3) Lastly, but of first importance, use of a better oil so that less was needed to secure adequate lubrication.

Stanoil #31 was the answer in this case. After three months' use there has been no recurrence of receiver fires, and oil consumption has been reduced 50% with adequate lubrication of the compressor.



Three old problems and two solutions. Electric motors in an aviation engine plant were operated almost constantly. They were a heavy-duty type and carried heavy loads. All ran excessively hot—that was problem one. Grease leaked freely from the over-heated bearings—and bearing life was short—problem two. Finally, grease that leaked got on the motor winding, which required frequent cleaning—problem three.

The plant manager put all three problems up to a Standard Lubrication Engineer, who made two suggestions. Perhaps the wrong kind of grease was being used and too much was being applied. He suggested that they remove the fittings, hand-pack the bearings, and use a highly stable grease—Stanobar Grease #2. A test was made on one particularly troublesome motor. After six months it was established that the three problems had been solved. Bearings ran cooler, leakage was eliminated and there were no bearing failures. Now all motors get the same treatment and give the same results.

Can't throw Stanodrip. Lubrication of box stitching machines is a tough job. Action of many parts on the machine is very rapid and jerky. Ordinary lubricants used tended to fly off in all directions. Oil on the wood spoils the box. Oil on operators and floors means less oil stays on the machine.

Machine operators were the first to cheer for Stanodrip when it was tested. They spent less time putting oil in the machine and taking it off of themselves. There was less spoilage, less trouble from machines because of too little lubricant. Stanodrip is on this job to stick.

Beat wartime three-shift operation to the draw. Hydraulic system operation in a Detroit plant went from one eight-hour shift to three shifts a day, seven days a week, under war production. On one-shift operation hydraulic oil was changed once a year in the system of an extrusion press. A change was made to Stanoil to see if this oil change period could be lengthened. Then came the shift to wartime tempo in production. Under the new conditions hydraulic oil had to stand more than three times the punishment—continuous heat, agitation, contamination, etc. But operating conditions made it necessary to keep Stanoil on the job a year. Then a sample was tested in the Standard Oil laboratory. It was reported to be in excellent condition—low acidity, good color, etc. This report, however, did not surprise the plant superintendent. He had already had a sample tested by an independent laboratory. Its report was even more favorable. Stanoil was still fit after more than three times the service which formerly required changing oil.

For the want of a nail the battle was lost. Here's the counterpart—in reverse—of the story of the General who lost the battle because his horse lost his shoe. A contract deadline was made because the right lubricant was found.

This war contract called for producing a certain number of very large units in 105 days. A small but important part of the unit was produced on a large horizontal milling machine. If this machine could be speeded up 10% the necessary production schedule could be met. But the manufacturer experienced trouble with a worm gear on this machine, and hesitated to increase the speed because of excessive wear.

The problem was explained to a Standard Lubrication Engineer. He recommended a special type lubricant. After a thirty-day run, which was the average life of the worm gear, an inspection was made. No appreciable wear was found. This saved a 24-hour shutdown for replacement. Production was resumed and another run of 70 days was made without repairs. The contract was completed in 100 days.

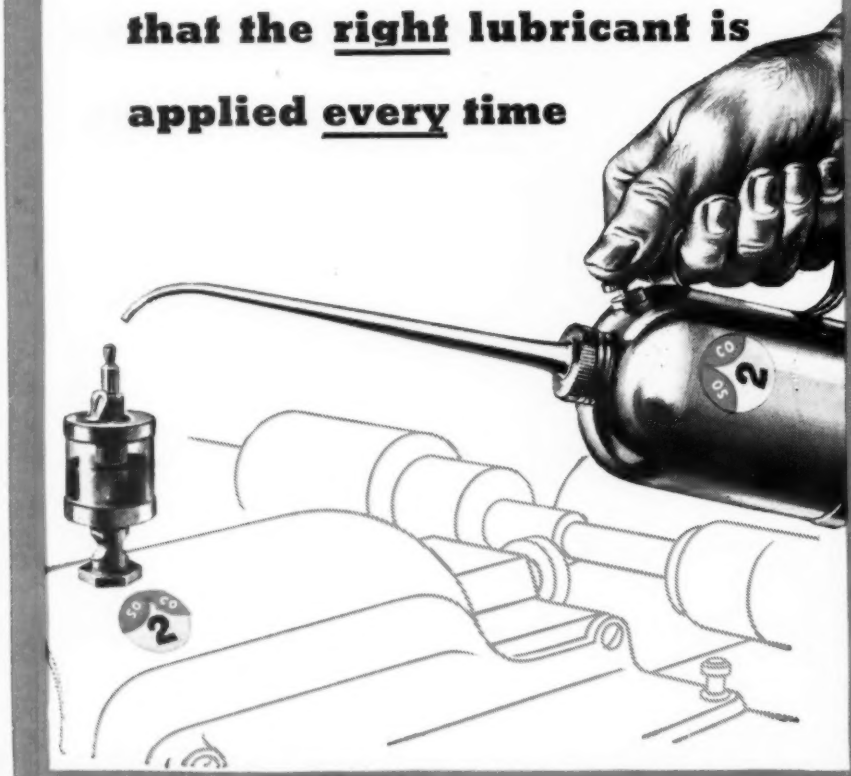
Gasoline Powers the Attack . . . Don't Waste a Drop!

What are your problems in machining and lubrication? Take the time to explain your problems to a Standard Lubrication Engineer. He may have a number of suggestions that will help you save manpower, materials, and equipment needed now. Call any Standard Oil Company (Indiana) office, or write 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICAT

An easy way to make sure that the right lubricant is applied every time



Standard Coded Lubrication Service

CODED LUBRICATION is one of the most important forward steps to insure better lubrication that has been made in many years.

In spite of past progress in producing better lubricants and the time spent developing better methods of application, one question still remained—was the *right* lubricant used on *every* application *every* time?

Now Standard Coded Lubrication Service answers this question completely. A simple lubricant numbering system makes it practically impossible for a conscientious oiler crew to misapply lubricants.

Standard Coded Lubrication Service is described at the right. Note these advantages over other systems you may have tried.

1. Only two color combinations and simple numbered decals are used to designate various lubricants.
2. The color combinations, red and yellow, and blue and yellow are easy to distinguish in any light.
3. The numerals are easy to recognize and remember even by those who do not know English.
4. Only one simple record is needed, which is made up when the system is installed. There are no complicated forms to fill out or keep up to date.
5. The code numbers used, apply only to the lubricant used in your plant and not to SAE or the maker's brand or grade numbers.

Send for the booklet fully describing Standard Coded Lubrication Service. If your plant is located in the Middle West a Standard Oil Industrial Service Representative will be glad to discuss this system with the men in charge of your lubrication.

Gasoline Powers the Attack . . .
Don't Waste a Drop!

FREE BOOKLET TELLS HOW

this simple code system may be fitted to your lubrication plan:

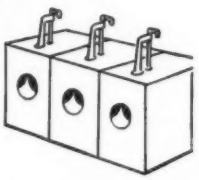
Flexibility and adaptability are outstanding features of this system. Note that it is a *numerical* system not to be confused with complex "color scheme" systems. Here are the few simple steps in this plan. A code number is assigned to each lubricant in your plant. Numbered decalcomania transfers are furnished by us in quantities sufficient to be applied to:

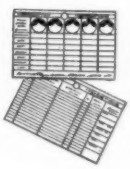
—every point of lubrication on every machine

—every grease gun or oil can used in servicing equipment

—every container or drum on your lubrication cart where they are used

and every barrel, drum, or storage tank in your oil house.





Machine Record Cards: Where desired, a supply of machine record cards (4" x 6") is provided.

Lubrication Chart: For control purposes, a card is provided to list, by brand name and code numbers, all lubricants used in the plant. This card is used by stock clerk or stockkeeper to enable him to requisition products by brand name, and to mark barrels with the correct code numbered decal.

This Booklet gives full details of how Standard Coded Lubrication Service can go to work in your plant. Ask your Standard Oil Man for a copy. Talk it over with him and the men in charge of your lubrication. See how this plan fills a gap in your lubrication program. Call the nearest Standard Oil Company (Indiana) office, or write 910 S. Michigan Avenue, Chicago 80, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

HOW'S YOUR VOLTAGE?

You can often iron out difficulties by regulating voltage--and SAVE

New England lab cuts testing time

This laboratory, testing electronic tubes and communications equipment, was getting uncertain test results because of a fluctuating incoming line voltage. It was necessary to repeat some tests over and over to assure accuracy. G-E engineers suggested installing three 3.6-kva, 120-volt automatic induction regulators. These regulators now furnish the exact voltage required for each test, and hold it constant throughout the test. Over-all testing time has been cut in two.

Aircraft plant saves—and speeds inspection

A midwestern manufacturer X-rays all propellors before releasing them for duty, to make sure that they are perfect. Considerable time was being lost because of fluctuations in the voltage applied to the X-ray machine. Underexposure or overexposure of X-ray film was the rule rather than the exception. Numerous "retakes" were necessary. This problem was ironed out with an automatic G-E 2.4-kva, 240-volt, induction regulator. Not only was time saved and production increased but the savings in X-ray film alone paid for the regulator in three months.

Western power company saves critical material

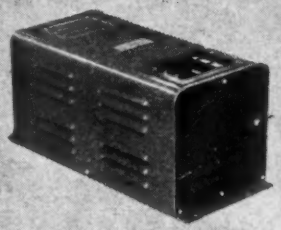
A western radio station experienced trouble because varying loads caused voltage fluctuations on the feeder supplying the station with 240-volt, three-wire, single-phase service. For the power company serving this area to install an *independent* feeder, would have required a large amount of critical material, and would have been difficult because of its effect on the station's elaborate antenna counterpoise. This problem was solved by installing a 2.4-kva G-E induction regulator on the *existing* feeder. Voltage regulation is now reported excellent.

What is your problem?

Pepless motors, poor lighting, uncertain test results, and production slumps are often the result of poor voltage. Whether you need voltage control for an electronic tube or a power shovel, there's a simple, economical G-E device for the job. Ask your G-E representative for further information. *General Electric Company, Schenectady 5, N. Y.*

Motor-operated regulator typical of sizes 3.6 kva and smaller. For automatic operation, control panel is furnished separately.

OTHER G-E AIDS TO BETTER VOLTAGE



VOLTAGE STABILIZER—Automatically provides a constant 115-volt supply to a given load, on circuits varying from 95 to 130 volts. Ratings from 50 to 5000 va. Ideal for precision laboratory or manufacturing processes, or built into such equipment as radio transmitters.

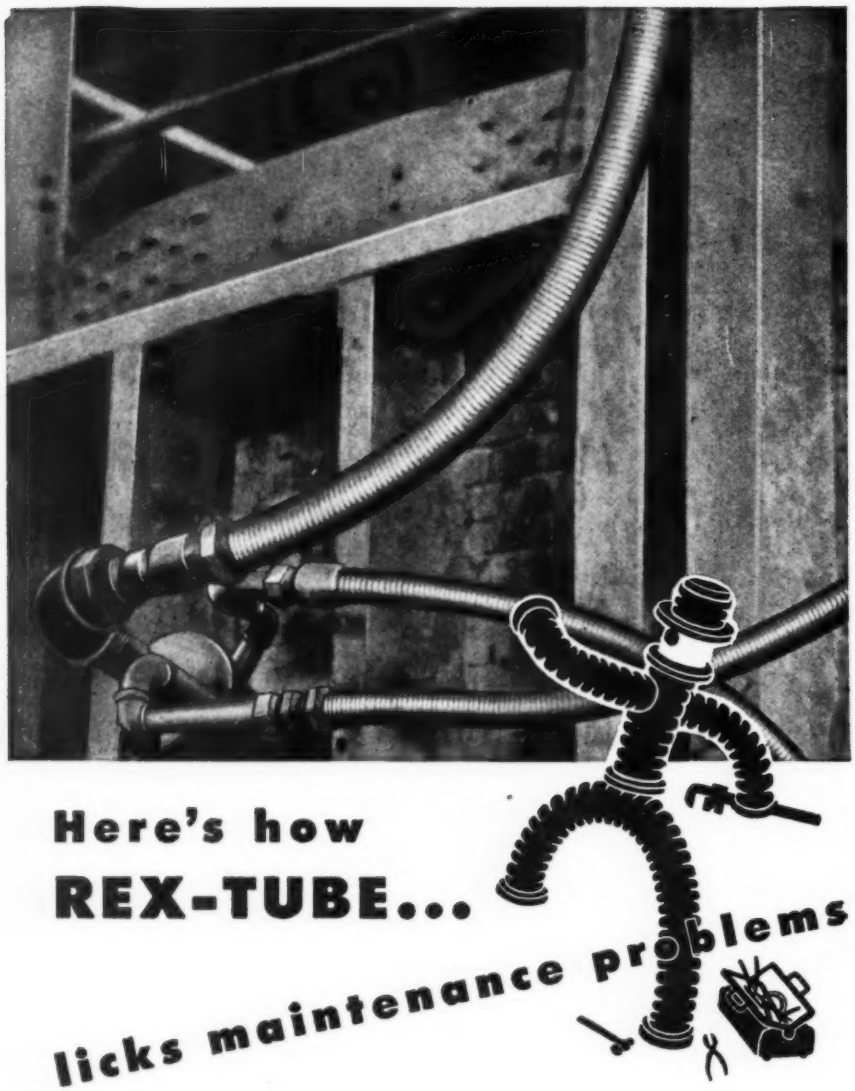
VARIABLE-VOLTAGE AUTO-TRANSFORMER—Provides smooth, adjustable control of voltage, current, light, temperature, power, and speed at a turn of the dial. Ratings from 243 to 810 va. Ideal for use in factories, laboratories, and assembled with other equipment.

TYPE D TRANSFORMER—For insulating lighting circuits, reducing light flicker, boosting or stepping down voltage for the most economical operation of motors, welding equipment, etc. Ratings up to 100 kva, 600 volts.

THE RIGHT VOLTAGE AT THE RIGHT PLACE DOES THE JOB BETTER

GENERAL ELECTRIC

403-66-5205, 5400



Here's how REX-TUBE... licks maintenance problems

Chicago Metal Hose Corporation's "Rex-Tube" is used on many types of original equipment. In addition, this standard flexible metal hose is used for maintenance requirements throughout industry in general, frequently replacing more cumbersome and troublesome piping hook-ups.

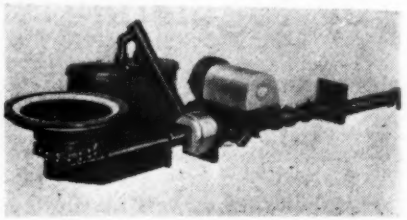
The application *always* determines the type of flexible metal hose that should be used. Chicago Metal Hose Corporation manufactures the most diversified line of flexible metal hose products. Therefore, C.M.H. engineering recommendations are complete and unbiased.

The complete line of Chicago Metal Hose Corporation fittings makes installations easier and faster. If you are concerned with the replacement of flexible metal hose, write for complete information.

Flexible Metal Hose for Every Industrial Use

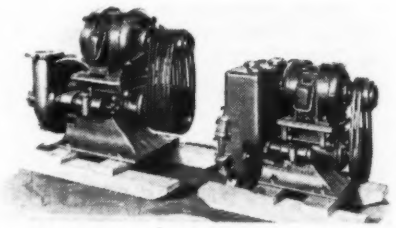
CMH CHICAGO METAL HOSE CORPORATION
MAYWOOD, ILLINOIS
Plants: Maywood and Elgin, Ill.

which limits hp ratings of standard worm-gear units, by drawing cooling air through the double-walled ribbed housing with a suction fan mounted on worm shaft. At 1750 rpm a great space saving and about 40% reduction in weight is effected. *Philadelphia Gear Works, Erie Ave and G St, Philadelphia 34, Pa.*



Ash-Removing Anthracite Stokers

FOR SMALLER commercial requirements, Winkler ARA models, in both hopper and self-feed types, feature Winkler *Inter-Planetary* fully automatic transmission, which has no shear pin, a rotating burner head, a screw-type elevator and *Eez Air* flyash-reduction control. Larger models feature the Winkler *Inter-Plan* transmission, narrow burners and air passage tuyeres. *U. S. Machine Corp, Lebanon, Ind.*



Centrifugal Pump

A NEW ARRANGEMENT offers the horizontal centrifugal pump with motor mounted overhead. According to maker, advantages of the Amsco-Nagle centrifugal pump include: (1) operation at more accurate speeds (2) speed changes where the particular duty calls for them (3) motor in a more accessible place, with protection, at the same time, against flooding (4) less floor space for installation. Motor mounting described above is available in two types of pumps, both horizontal: *T* in 5-in. size at left of photo; *A* in 2-in. size at right. *American Manganese Steel division, American Brake Shoe Co, Chicago Hts, Ill.*

Joint-Sealing Compound

LUBRICANT FOR CONNECTION of threaded pipe joints and studs and bolts in assembly of power-plant and machine-shop equipment. Leakproof for air, gas, oil, water, steam, ammonia, it will not harden or soften under most severe variations in temperature and pressure. Compound consists principally of metallic lead; manufacturer claims it will not cause threads to seize; instead, it reduces friction, smooths small irregularities and makes possible breaking of the joint. Easily applied with a brush, it will not disassociate with age or exposure to air. *I H Grancell, 1601 E Nadeau St, Los Angeles, Calif.*

Scovill Tube News

Vol. 2 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn No. 4

Corrosion of Condenser Tubes ...Causes and Cures

Scovill offers two folders on obtaining longer tube life

Among the common causes of corrosion in condenser and heat exchanger tube metal are the following, each of which is discussed in two folders which have been prepared by Scovill Manufacturing Company engineers as one of three Scovill services to power plant operators:

Film Formation

The ability of copper and its alloys to form protective films on their surfaces explains their inherently excellent corrosion resistant properties. In order to be protective, the film must be adherent, continuous and relatively insoluble. The formation of soluble salts at the metal surface will lead to continued corrosion. Likewise, coatings which are porous, loosely adherent, friable or easily broken, or discontinuous, offer little protection to the metal.

Accelerated Uniform Corrosion

Tubes in service under conditions which result in corrosion at the tube surface with the formation of soluble salts only, will undergo a uniform thinning of the tube wall. This is often experienced in acid solutions, particularly with oxidizing acids or acid solutions containing oxygen or an oxidizing agent. Solutions which have a definite solvent action on the products of corrosion of copper alloys, such as solutions containing ammonium hydroxide or cyanides, would behave similarly.

Impingement Attack, End Corrosion, etc.

Rapid and repeated destruction of protective surface films usually occurs at or near the inlet end of the tubes and is variously described as "impingement attack, end corrosion, etc." There are usually certain localized areas in a unit or sections of a unit where failures from this cause predominate. The destruction of protective films at such localized areas is due to a relatively high velocity of the circulating medium, together with a turbulent condition and the action of entrained or separated air.

Concentration Cell Action

Many cases of localized corrosion and failure of condenser and heat exchanger tubes are due to local differences in solution, concentration or composition which may develop at the metal surface. A break in an otherwise satisfactory protective film may initiate such action. Cracks, crevices or other small openings at baffle or support plates where liquids may seep and become trapped are always a potential source of trouble in this respect.

Deposit Attack

Corrosion of the "deposit attack" type (a special form of "concentration cell" action) is directly due to the settling out or lodgment on the tube wall of sand, mud, coke, stones, wood, shells, flakes of iron scale, etc. Part of the metal surface becomes shielded or protected by the deposit and usually becomes anodic to adjacent metal areas; intense pitting at such shielded areas is likely to occur. If the deposit is of sufficient size to interfere seriously with the flow of the circulating medium, turbulence, air separation and erosion-corrosion of the down-stream side of the tube may take place.

Plug- and Layer-Type Dezincification

Brasses containing less than 85% of copper may undergo corrosion which results finally in the gradual replacement of the brass by a spongy, porous copper deposit. This deposit may occur locally, developing into "plugs" of copper, or it may occur uniformly over the tube surface — in which case it is designated as "layer-type" dezincification. Conditions which favor dezincification of condenser tubes are:

(1) Contact with waters slightly acid in character and of a low degree of aeration.
(2) Relatively low velocity of water over the tube surfaces, or stagnant water in tubes.
(3) Relatively high temperatures.
(4) Certain types of permeable scales on the metal surface.

Galvanic Action

The indiscriminate use of dissimilar metals and alloys in any service, when they make good contact and are also subjected to a conducting medium, may lead to the early failure of one member of the couple. In the design of equipment which is to be used for handling liquids, moist gases or vapors, therefore, the possibility of galvanic corrosion should be given careful thought.

Such are the common causes of trouble. The cures for these troubles may be determined with the aid of Scovill's two other services:

Service in Men, which gives you the benefit, through consultation, of the many years' experience represented by Scovill engineers.

Service in Metals, which gives you complete laboratory and production facilities (as national needs permit) in the working-out of a solution to your problem.

For a further demonstration of *Service in Manuals*, of which the foregoing information is a sample, write us for Scovill's free "Condenser Tube Booklet", containing diagrams, formulae, description of alloys. Address Scovill Manufacturing Company, 13 Mill St., Waterbury, Conn.

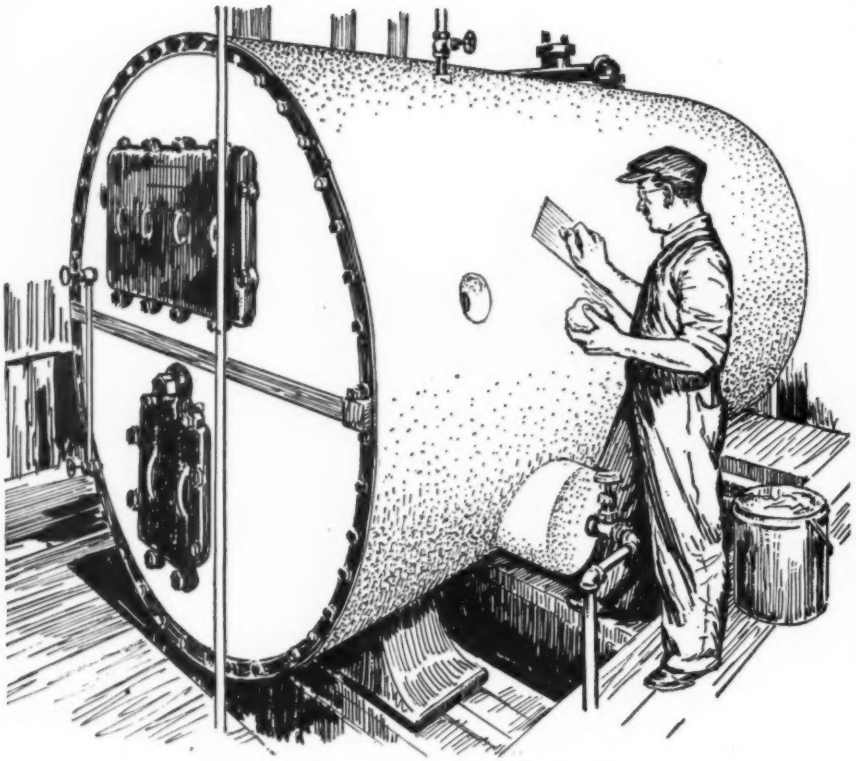
THIS IS NUMBER TEN in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men



AN INSULATING CEMENT THAT

stays put

Once it's on, it's on to stay — and that means real savings in time, money, and materials.

Baldwin-Hill No. 1 Insulating Cement contains a special rust-inhibitor that prevents corrosion between metal surfaces and the cement. Whether the cement dries out immediately on a hot surface, or air-dries over a long period of time, it will not affect the bond. Ordinary expansion and contraction of the insulated surface are not problems, either. B-H No. 1 Cement is elastic enough so that it will not crack and peel.

Made of B-H *black* rockwool, it is effective up to 1800° F. It is the ideal maintenance insulation for valves, fittings, and large pieces of equipment where molded-type insulation is not practical. Makes an excellent finish, too, for covering blanket and block applications. Send for sample and information.

Baldwin-Hill Co., 575 Klagg Ave., Trenton 2, N. J. Plants in Trenton, N. J., Kalamazoo, Mich., and Huntington, Ind.

Baldwin-Hill

BH COMPANY

HEAT & COLD INSULATIONS

Readers' Problems

(*Continued from page* 116)

water outlet for air bubbles with line submerged in a pail of water. Check crank and head-end water jackets.

If piston clearance is excessive new rings will not help and cylinder must be rebored and new oversized piston and rings fitted. Also check intercooler pressure. Low pressure indicates 1-p cylinder valves or rings defective and high pressure indicates h-p cylinder trouble. Consult the manufacturer for permission to speed the machine up 5 or 10%.

See that intake valve springs are lighter than on discharge valves and also that intake and discharge valves are not interchanged. Valve springs should be easily identified because too heavy spring tension on intake valves reduces capacity considerably.

Valve lift is generally fixed by a space washer between top and bottom half of valve. The spring plate's lift should never be changed. If lift is reduced by using a thinner washer, pressure drop across valve is higher. This constricted opening causes the valve to heat giving the impression that it is leaking.

Ottawa, Ont. JOSEPH BONGIORNO

Install Flowmeter In Discharge Line

THERE IS NO DOUBT that the expense of extending the compressor suction outside would be thoroughly justified unless the outside temperature is near 100 F.

It is obvious that the high-temperature indoor air, being greater in volume reduces the unit's performance as it may already be too small for the demand. Although air is not a perfect gas, we can reasonably apply Charles' Law, which says, "The volume of a perfect gas at constant pressure is proportional to its absolute temperature."

For example, assume the indoor air at 100 F and outdoor air 40 F. Then the absolute temperature would be (460+100) and (460+40) or 560 and 500 F respectively. Then $\frac{560}{500}=1.11$ or 11% greater volume at higher temperature, which means the compressor must do 11% more pumping to obtain the same amount of compressed air.

Now if the steam engine unit is 80% efficient at normal load, this added work on the compressor means a 2% reduction of the steam engine efficiency. Cost of the change would soon be refunded.

Keep mechanical parts of the com-

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Dear Sir:
It is with great pleasure at this time to take the opportunity to extend to you, both from myself and through my Company, the heartiest of thanks for your splendid cooperation in completing our recent rush order for pipe bending.
Through your cooperation we were able to save many valuable days essential to the war effort, and we feel justly proud in being able to transact business with such a concern as yours.
Thanking you again for all past favors, I remain
Yours very truly,
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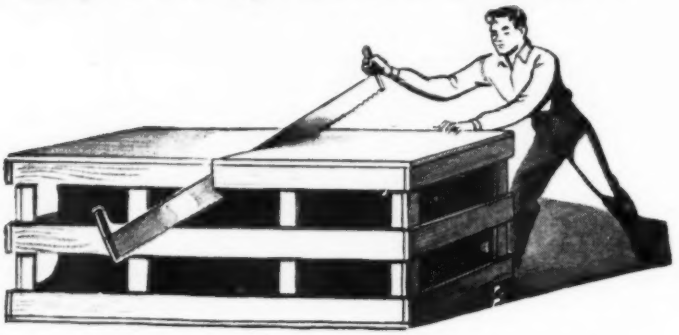

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pressor in as nearly perfect condition as possible and the surfaces of water jackets and coolers clean.

Flowmeters are available that register air flow and it would be a good investment to install one on the main discharge line. Compressed air is a convenient tool and far too expensive to waste. To test the actual output, if at all possible run a test with two tanks, just as a water test is run on a steam turbine to measure condensate from the unit.

The tanks may be arranged so that one is filled with water, the top air inlet to it opened, and the water forced into the other tank, while its top air outlet is open to the discharge line. Then the cocks can be changed and the process reversed, the water then being forced back to the original tank while the air discharges from it. Water level can be observed by a gage glass fitted to each tank.

This process, of course, is a manual operation, but gives a true picture of what the machine is doing. Tanks must be sufficiently strong to withstand the pressure and fitted with the necessary safety valve and pressure gages. A properly installed pitot tube also indicates the amount of air flowing in the discharge line.

Regarding the steam side of the unit, it would be well to take a set of cards at various loads and check for possible efficiency loss.

Kearny, N. J. GEORGE MCNALLY

Inspect Lines for Leaks

INSPECT THE LINES to departments using air and repair all leaks. After checking lines, inspect the machine to see that valves operate properly. Also check piston and cylinder.

Knowing the machine's bore, stroke and speed, find its capacity by pumping up the receiver to full pressure and timing the operation.

A combination of several things, and not the compressor, may be at fault, so check the entire system, including compressor and engine. Make sure the valves operate properly; they may need grinding.

Perhaps it would be best to get another machine and use the steam-driven compressor for standby.

Philadelphia, Pa. T F CUNNINGHAM

George F Bateman, dean, Schools of Engrg, Cooper Union, New York City, was elected pres, N. Y. Electrical Society at the organization's 594th meeting. He is the 55th president.

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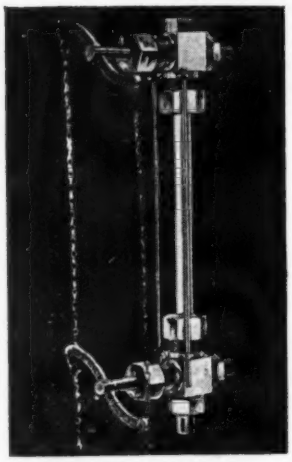

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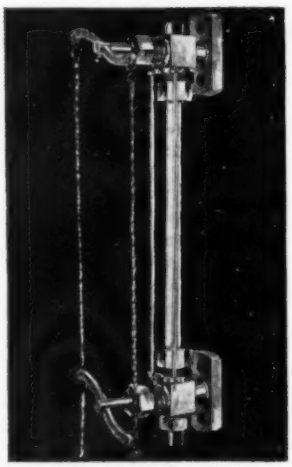

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Postwar Use of Superchargers to Increase

Editors and writers of the industrial and business press gathered in Milwaukee, June 21, for a conference on postwar trends in internal-combustion engines, with special reference to increasing their power by supercharging. The hosts were Borg-Warner Corp and their Milwaukee division, McCulloch Engineering Corp (now B-W Superchargers, Inc).

C S Davis, president of Borg-Warner, announced a change in the name of McCulloch Engineering Corp to B-W Superchargers, Inc, effective at once. Mr Davis and other executives talked briefly on the future of the internal-combustion engine in the postwar world and the improvement in its power and efficiency that is being effected by supercharging.

According to Mr. Davis, wartime emphasis on engine performance has greatly stimulated interest in superchargers. While production today is devoted entirely to war-

Visitors see superchargers in the making at the B-W supercharger plant

time needs, there lie ahead interesting questions of reducing costs and increasing engine efficiency through supercharging wherever internal combustion engines are used. Purchase of McCulloch Engineering Corp by Borg-Warner, said Mr. Davis, marked their entry into the supercharger field, another step in their program of diversification and expansion in the automotive, aviation, tractor and marine fields.

E W Wasielewski, chief engineer of B-W Superchargers, Inc, then addressed the group. He pointed out that the war brought with it a need for large numbers of internal-combustion engines for stationary, marine and transportation uses. Maximum possible power had to be obtained from these engines and supercharging was the obvious solution. McCulloch Engineering Corp developed and produced the positive-displacement supercharger, which they considered best adapted to these applications. Mr Wasielewski said these superchargers are used today on a large number of engines, mostly

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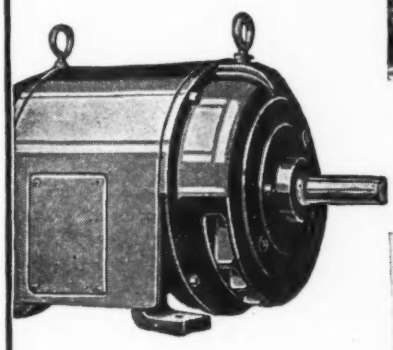
Applying these functions to boost production and improve quality is APPLICATION ENGINEERING. That's our business.



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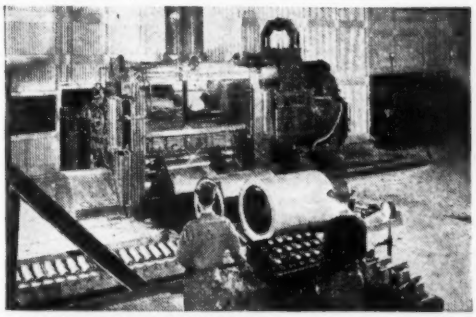
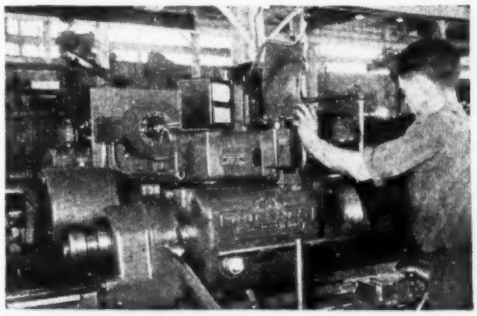
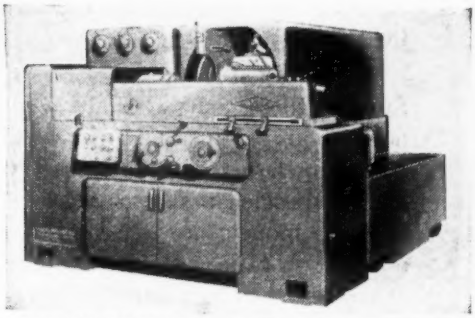
TENSION CONTROL (2569) Reliance Motor-drive for Tension Control is a good example of taking full advantage of characteristics inherent in the motor. It eliminates troublesome clutches . . . contributes substantially to the quality and uniformity of product which must be processed under tension.



TANDEM OPERATION (3124) The processing of materials in coil form is facilitated by the use of Reliance Tandem (or Range) Drive. Material moves faster with less handling . . . driving parts are simplified, space is saved. This is a subject of every-day consideration at Reliance.



SPEED CONTROL (4578) Nothing offers greater possibilities for the simplification of machine design than Reliance Adjustable-speed Drives. Available for both A-c. and D-c. Ease and convenience of control contribute to all-day, top-notch production.



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The early colonial was a stickler for thrift! Saving was made a game and banks like the one pictured here were a conspicuous part of every household. Ingeniously constructed they were, too, for they were made so that once the money was inside you could not take it out unless you broke the bank . . . and woe betide the one committing such a sin.

Thrift is playing its same important role in today's war and the pennies, dimes, and dollars of true Americans are shaping and powering mighty dreadnoughts, miracle Fortresses of the air and an endless stream of other Victory-making war material. Our country is dotted with hard-hitting production plants . . . monuments to the savings of each of us who, day after day, is helping to make America a better, a happier, and a safer place in which to live . . . savings that finance the war . . . with War Bonds.

War Bonds keep our Boys on the march . . . to Victory. Save for them. Start a family War Bond game in your home. Pool your pennies, nickels, dimes and dollars just as our forefathers did back in Revolutionary days. Set aside a specified time each week or month to turn this saved-up money into fighting War Bonds. Then, when the rainbow of Peace beautifies America's horizon, those dream things of tomorrow can be yours . . . they can be paid for with the War Bonds you buy today.

A War Bond Message Designed and Contributed by
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DUST RECOVERY SYSTEMS

diesels, for high-speed boats, landing craft, other marine uses, locomotives, and generating units for military installations. Power of these engines has been increased by supercharging 20 to 30%, and sometimes more.

Although the increases in engine power so far developed by supercharging have been moderate, there appear no obstacles to doubling engine power by this means, in Mr Wasielewski's opinion.

J P Stewart, assistant general manager of B-W Superchargers, Inc, gave many interesting sidelights on trends in engines and superchargers. Probably the most spectacular trend in diesels, according to Mr Stewart, has been the shift from the 4- to the 2-cycle in the last decade. Before the war, 2-cycle engines were rarely built below 1000 hp, but recent Navy statistics show that 75% of all its installed diesel horsepower is 2-cycle, much of it in small engines. Diesel builders are now developing 2-cycle engines ranging from 15 to 2500 hp, and operating on the whole at higher piston speeds than the 4-cycle.

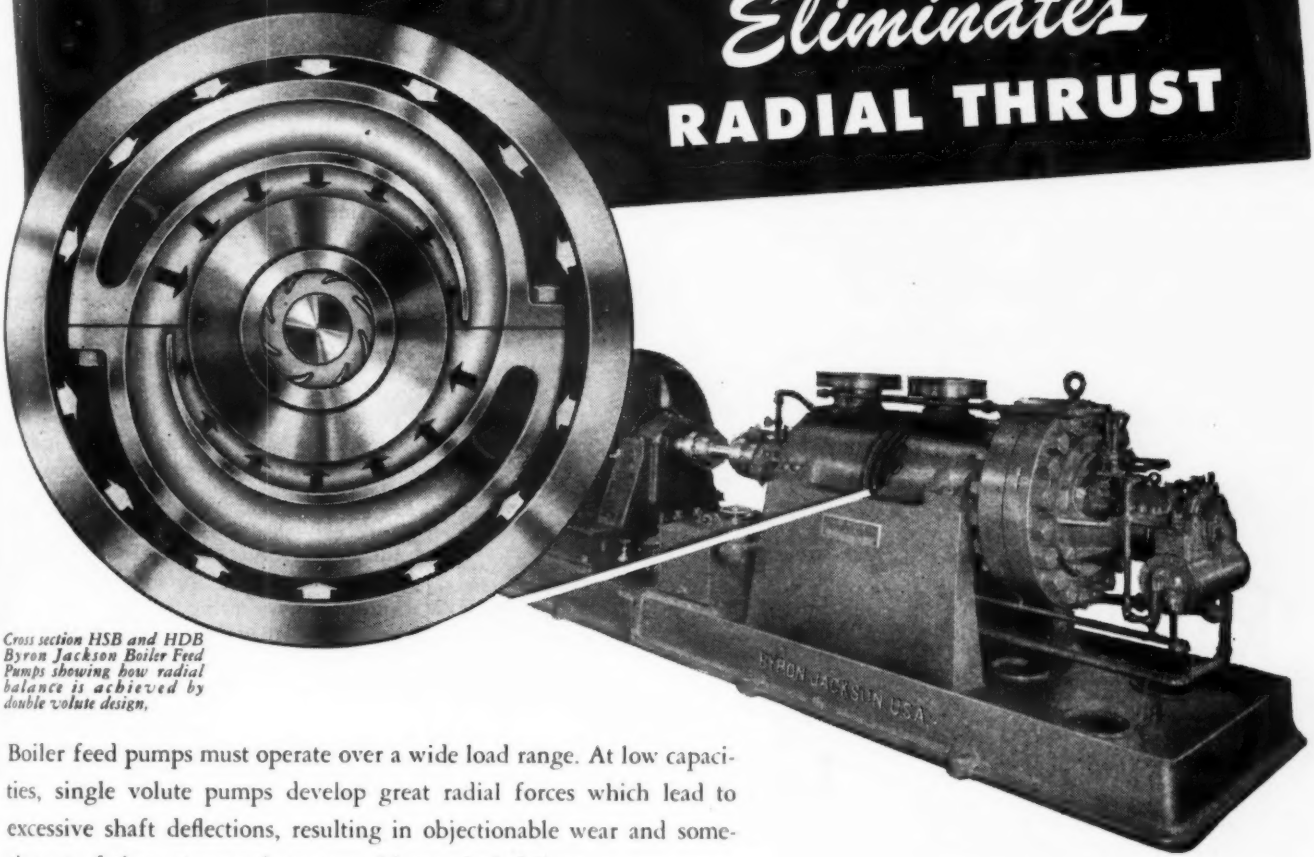
Mr Stewart is certain this development of 2-cycle diesels makes it necessary for the 4-cycle diesel to be supercharged to obtain the higher mean effective pressure for meeting the competition of the 2-cycle engines. Piston speeds must also increase. Supercharging alone has boosted power of 4-cycle engines from 30 up to 50%. In one case by a combination of supercharging and increase of rotating speed, a 4-cycle engine was raised from 1000 to 1960 hp. Increases of 75 to 100% above prewar ratings may, therefore, be expected for 4-cycle engines.

Supercharging Methods

Mr Stewart pointed out that there is no universal method of supercharging to cover all requirements. In this country, turbo-superchargers have so far been used mainly for high altitude aircraft engines and for 4-cycle diesels rated between 500 and 2000 hp. The advantages of this type are in its self-regulating characteristics and its overall efficiency, derived from utilization of the energy in the exhaust gas from the engine. Principal obstacles to the broader use of the turbo-supercharger on small engines have been first cost and problems incident to the high temperature of the exhaust gas. Neither objection is insurmountable, and the next few years may well see a broader use of turbo-superchargers for both gasoline and diesel engines. Mechanically driven centrifugal superchargers have been used little outside of aircraft engines, but much progress has been made in improving their efficiency.

In his closing remarks, Mr Stewart said: "The mechanically driven positive-displacement blower is used almost universally on 2-cycle engines, from the smallest to the largest, to remove or scavenge the exhaust gas, and with higher pressures to supercharge. It is used as a supercharger for 4-cycle diesels rated below 500 hp. A greatly increased demand for this type of supercharger on 4-cycle engines may be anticipated. From the standpoints of simplicity, reliability in operation, and low first cost, it has no superior. With this type of supercharger, the economic requirement of providing additional power at less cost than by building a larger unsupercharged engine can be met."

In Byron Jackson High Pressure Boiler Feed Pumps
DOUBLE VOLUTE DESIGN
Eliminates
RADIAL THRUST



Cross section HSB and HDB Byron Jackson Boiler Feed Pumps showing how radial balance is achieved by double volute design.

Boiler feed pumps must operate over a wide load range. At low capacities, single volute pumps develop great radial forces which lead to excessive shaft deflections, resulting in objectionable wear and sometimes to fatigue stresses that cause ultimate shaft failure.

To overcome such action, in Byron Jackson Double Case Pumps these radial pressure loads are balanced out completely by the use of Double Volute Inner Cases. Each volute is divided into two identical fluid channels in the plane of the impeller, with outlets 180° apart, resulting in opposed forces of equal magnitude and radial balance without pressure bending moment on the shaft at any capacity.

Capacity range of the Type HSB pump is from 100,000 to 400,000 pounds per hour. Type HDB is from 350,000 to 1,000,000 pounds per hour. Pressure range of both types is from 1,000 to 2,000 psi. in standard designs.

The benefits of our accumulated experience in designing pumps for high pressures and temperatures is available to you upon request.

(ABOVE LEFT)
Single volute, illustrating the unequal distribution of forces between intake and discharge points.

(ABOVE RIGHT)
Double volute, showing the equality of opposing forces at any given point of the entire circumference.

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RANDOLPH LABORATORIES
Scientific Fire Equipment

Questions & Answers

(*Continued from page* 122)

to clear the furnace of oil vapor before lighting up again.

(c) If, for any reason, unburned oil collects on the furnace floor, the gas distilled from this oil must be carried away and the furnace entirely cleared of any explosive gas-and-air mixture before attempts are made to light the burners.

(d) Use strainers where necessary in oil lines and clean them regularly.

(e) When atomizers are not in use, remove and thoroughly clean them.

Q 10—What are the characteristic effects attending the burning of anthracite, bituminous and lignite coal?

A—*Anthracite,* being mainly composed of fixed carbon and ash, is low in gaseous constituents. Hence it ignites slowly, burns with a bluish flame and gives off little smoke. For best results, with hand firing, don't slice or disturb the fuel bed more than necessary.

Bituminous is more widely used than anthracite for firing power boilers. It varies greatly in composition but always has a higher volatile content than anthracite. In general it burns with a yellow flame. It may be coking or noncoking. Ash content and moisture may vary from very low to very high.

Lignite is usually lower in carbon content than bituminous and fairly high in volatile matter. Its moisture content is notably high. It burns with a smoky yellow flame. Though much lower in heating value than anthracite or bituminous coal, it is a satisfactory fuel when burned on grates and in furnaces of suitable design. Its high moisture content makes lignite hard to store for any great length of time without considerable slacking.

Q 11—What are the advantages of oil and gas fuel compared with coal?

A—Apart from cost, which varies with the locality, oil and gas possess considerable advantage over coal as boiler fuels. Oil requires less storage space, leaves no ash, burns better because of more intimate mixing with the air. Furnace and boiler room can be kept cleaner, labor costs lower. Very little excess air is needed to insure complete combustion. Gas possesses all the advantages of oil, plus elimination of storage space and of steam or mechanical atomizing requirements.

Both oil and gas are smokeless fuels, if furnaces and burners are properly designed. Standby losses are small because the fuel supply can be instantly shut off

The Parable of the Boy Who was Short-Suited

ONCE UPON A TIME there were a father and a mother who had a son. This, of course, was strictly according to the rules, since, to qualify as a parent, one must have either a son or a daughter. In this case it happened to be a son, and, as is the custom with all male children, this particular son grew up into a boy. Not all at once, mind you. In fact, his growth was almost imperceptible. First he was a baby; then a small boy; then a larger boy. Nothing sensational, you understand. So it isn't hard to see why his Pa and Ma hardly realized that Sonny was growing at all.

And then—all of a sudden—the kid started to sprout. In the short span of a summer vacation he shot up here, stretched out there, and bulged in various places. Luckily for the kid, his skin could stretch—but unluckily for the Old Man, the kid's clothes couldn't! Which was very sad indeed, because the Old Man had spent plenty of good green stuff on those same clothes only a few months back.

MORAL: If the Old Man had been smart, he would have bought clothes roomy enough to let the kid expand.

44348

The lesson of the foregoing is obviously this: Now, in the advanced stages of postwar planning, is the time to bring adequate wiring into the picture. Talk to your consulting engineer, electrical contractor, your utility power engineer. *Unwired planning will cost you a lot more than planned wiring.*

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Electrical Wires and Cables of Copper are the Life Lines of our Nation

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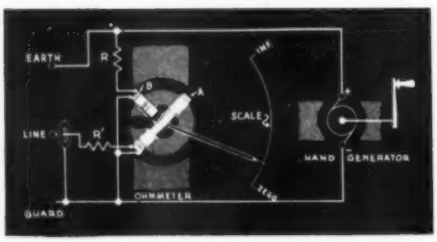
You will find the same ruggedness and dependability in U.S.-made "Megger" instruments that the electrical industry has known for so long a time.

Let us send you full details on various types and ratings. Ask for Bulletin 1685-P.

* *Trade Mark Reg. U. S. Pat. Off.*



PRINCIPLE OF OPERATION

In what we term a cross-coil true ohmmeter, two coils are mounted in fixed relation to each other on the same pivot-and-jewel moving system in the field of a permanent magnet. "Current" flows in coil A and "potential" in coil B, and they are connected so that their respective torques oppose each other. Since there are no control springs, the opposing coils give a true ratio of E/I, and ohms (or megohms) are indicated directly by a pointer over a scale. The readings are independent of the voltage of the hand-driven d-c generator, because any change in the voltage affects both coils in the same proportion.

JAMES G. BIDDLE CO. 1211 ARCH ST. PHILA. 7, PA.

or reduced to a minimum when the load is off.

Q 12—Why, then, is coal the primary boiler fuel in North America?

A—Because coal is far more plentiful than oil or gas and is (generally) available at a much lower cost per Btu, enough lower to offset the listed advantages of oil and gas in most regions.

Q 13—What are the advantages and disadvantages of pulverized fuel compared with stoker-fired solid fuel?

A—In general, with pulverized coal it is easier to get proper mixing of fuel and air and to reduce excess air percentages and standby losses. Also (with suitable furnaces) there may be greater flexibility in coal choice.

Disadvantages with certain coals may include slagging of tubes and furnace walls. Pulverized firing adds the cost of pulverizing, and in general discharges more ash from the stack.

Q 14—What are the main requirements for an efficient boiler furnace?

A—It should have enough volume to contain all the gases that may be developed at over ratings, and allow them to mix thoroughly with enough air for complete combustion. To insure complete mixing and ignition, it should have a long flame travel and a tortuous path for gas travel, using baffle walls and ignition arches where necessary.

Q 15—What are the main reasons for low efficiency in boiler furnaces?

A—Low efficiency may be caused by poor design and bad workmanship. Combustion space may be too small, gas travel too short, baffles in wrong place, refractory walls not properly bonded to outer setting.

Lowered efficiency in existing furnaces may be caused by excessive leakage of cold air into furnace through leaky brickwork, also by poor heat transmission through accumulation of soot or slag or boiler heating surfaces.

Q 16—How is air for combustion preheated, and what are the advantages of preheating?

A—Air for combustion purposes may be preheated before it enters the boiler furnace by passing it through banks of tubes placed in the flue leading from the boiler to the chimney, and thus using some of the heat that would otherwise pass to waste. Preheating has many advantages. Combustion is improved, efficiency and capacity are increased, and lower grade fuels can be burned successfully. The hotter air supply increases the furnace temperature with a consequent increase in combustion efficiency and greater transfer of heat to the boiler heating surfaces.

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When you buy a Worthington Monobloc centrifugal pump for water supply, boiler feed, circulation or one of its many other functions, you don't get just a pump hooked up to a conventional motor.

No sir! And here's why. We start with a rigid support. On one end we mount the correct Worthington *centrifugal* pump to do your job just right. On the other end—in perfect balance—we mount the correct motor to make your pump do its best work.

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Please don't misunderstand us. We don't tailor-make your Monobloc for you. That was all done in advance when Worthington became the first manufacturer to build a complete line of electric-driven *centrifugal* pumps of the Monobloc design that are truly balanced units—planned and mated *on the drawing board.*

Monobloc pumps range in capacities from 10 to 1600 gallons per minute . . . in heads from 15 to 500 feet . . . in motor horsepower from ¼ to 60. First cost is low . . . maintenance is negligible. For complete details of Monobloc's other exclusive features and operating benefits, write us or telephone your nearest district office or authorized dealer for Bulletin W321-B14.

180 pages of vital facts about centrifugal, power, rotary and steam pumps; air compressors, liquid meters . . . all conveniently tabbed for easy reading. Use coupon below.

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These NEW Catalogs, Booklets and Bulletins Are Yours for the Asking!

BOILERS AND AUXILIARIES

1 **BOILERS**—Wm Bros Boiler & Mfg Co, Nicollet Island, Minneapolis 14, Minn. 8-page bulletin No. 144 features Bros 3-drum Type L boilers for maximum capacities from 10,000 to 75,000 lb per hr and for any desired operating pressure.

2 **BOILER COATING**—Preferred Utilities Mfg Corp, 1360 Broadway, New York 23, N. Y. 16-page booklet, entitled *New Approaches to Surface Protection*, discusses advantages of the *Preferred White Hot* and *Pyro-Chrome* for boiler combustion chambers, vaporizing oil-burner combustion chambers, electric furnaces, boiler fronts and walls, etc.

3 **COAL TREATMENT**—Johnson-March Corp, 52 Vanderbilt Ave, New York, N. Y. 4-page bulletin describes *Colspra*, a liquid chemical adhesive and wetting compound for consolidating, compacting and protecting coal storage pile surfaces.

MAINTENANCE AND SAFETY EQUIPMENT

4 **VALVE CHIPPER REPAIR**—Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y. Form No. 5634, a 22x38-in. wall chart, entitled *Easy Repair Operations for I-R Flapper Valve Chippers*, furnishes an *exploded-view* of the hammer, cross-section view, drawings of tools required for maintenance and recommended maintenance operations.

5 **GRATING AND STAIR TREADS**—Wm F Klemp Co, 6601 S Melvina Ave, Chicago 38, Ill. 24-page catalog No. 14-P-21 gives detailed construction particulars, drawings and tabular specifications and installation data on open steel grating and stair treads.

6 **MECHANICAL LUBRICATION**—Farval Corp, 3295 E 80th St, Cleveland 4, Ohio. Bulletin No. 25, 16 pages, portrays theory and practice of mechanical lubrication, showing how centralized systems increase production and save time, power and materials.

7 **THERMAL AND BOTTLE OILERS**—Trico Fuse Mfg Co, 2948 N 5th St, Milwaukee 12, Wis. Bulletin No. 28-A describes thermal oiler with plastic reinforced reservoir that automatically supplies proper amount of oil for solid, wick and waste-packed bearings. Bottle oiler has vibrating rod, which on slight vibration, or vertical movement, releases oil to the bearing.

8 **HAMMERS AND MALLETS**—Greene, Tweed & Co, Bronx Blvd at 238th St, New York 66, N. Y. 4-page folder, entitled *A Blow Without a Dent*, outlines advantages of new plastic faces and heads of the Basa replaceable-face hammers and Empire soft-face mallets; also shows hammers with rawhide, copper and babbitt faces and mallets with plain or loaded rawhide heads.

MECHANICAL TRANSMISSION

9 **BELT DRIVES**—B F Goodrich Co, Akron, Ohio. 44-page handbook describes industrial fractional-hp V-belt drives.

10 **WORM-GEAR REDUCTION UNITS**—Cleveland Worm & Gear Co, Cleveland, Ohio. 10-page catalog No. 300 discusses Speedaire fan-cooled worm-gear reduction units, including instructions for planning installations of units, with illustrative examples, and rating tables for six sizes, ranging from 4¾ to 12-in. centers.

11 **V-BELT DRIVES**—B F Goodrich Co, Akron, Ohio. 44-page handbook notes trend toward larger sheaves in fractional hp and multiple V-belt drives, describes construction of Goodrich fractional hp V-belts and gives prices and data on sheaves and belts.

METERS AND INSTRUMENTS, MECHANICAL

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **HYDRAULIC GAGES**—Watson-Stillman Co, Roselle, N. J. 4-page bulletin No. 230-A describes direct-stem and flush-mounted gages for hydraulic presses and pumps.

12 **RATIO METER**—Cochrane Corp, 17th St at Allegheny Ave, Philadelphia 32, Pa. Publication No. 4071 discusses methods of checking combustion efficiency in boiler plants, gives requirements for an ideal boiler meter and presents the Cochrane boiler ratio meter.

13 **FLOW-RATE MEASUREMENT**—Simplex Valve & Meter Co, 6800 Upland St, Philadelphia, Pa. Bulletin No. 420 describes operation of W-K Principle in combination with Simplex MO meter. Meter indicates, records and totalizes flow-rate measurement of differential taps in water turbine.

PIPING, FITTINGS, VALVES AND SPECIALTIES

14 **VALVE CARE**—Reading-Pratt & Cady div, American Chain & Cable Co, Bridgeport, Conn. *Do's and Don'ts* valve chart gives tips on handling and care of valves, pointing out common mishandlings that reduce valve life. Printed on heavy stock for posting.

15 **SPIRAL - WOUND GASKETS**—United States Gasket Co, 1520 Pierce Ave, Camden, N. J. Catalog No. 202 presents Ajax gaskets for pressures from 10 to 3500 psi for power, municipal, chemical and industrial installations.

(*Continued on page* 180)

HOW TO ORDER

Be sure to fill out, completely, one coupon for each piece of literature you order. (See sample below.) This gives your request authority and helps the manufacturer to address your copy completely. Readers who fail to prepare request blanks correctly may be disappointed under difficult postal conditions and limited quantities of bulletins available today.

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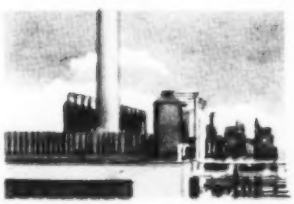


PIPE—like many other metal products—is produced and fabricated faster and at less cost with the help of LINDE METHODS

The oxy-acetylene processes shown here . . . flame-cutting, welding, wrinkle-bending, and flame-priming . . . are but a few of the Linde methods used daily to save time, money, and materials in fabrication of industrial piping . . . piping for synthetic rubber plants, power stations, petroleum refineries, ships, chemical units, and mills and factories of all kinds.

Linde's method of wrinkle-bending pipe, for example, quickly produces smooth-sweep bends to fit the system as work progresses . . . without need for fittings. Wrinkle-bending also is used to a great extent in the construction of overland pipe lines.

There are other Linde methods to speed construction . . . methods for flame-shaping steel plate for storage tanks by means of portable oxy-acetylene cutting machines . . . for flame-priming structural steel and plate to make paint last longer . . . and for cutting and welding together sections of pipe to fit a variety of needs.

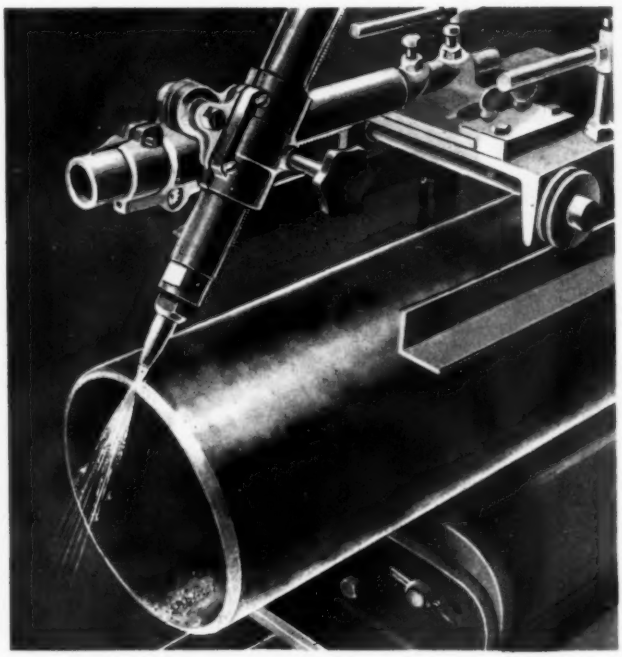
Linde-developed processes also are important in the production of pipe and tubing as well as in its fabrication. In the next three pages you can learn more about some of these Linde developments. The pictures and captions may suggest useful applications in your business.

Methods developed by THE LINDE AIR PRODUCTS COMPANY

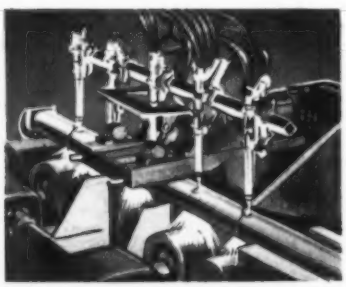
MAKING PIPE

UNIONMELT Welding – Makes high-quality welds in steel of any thickness at unusually high speeds. This automatic electric welding process is used to fabricate spiral pipe, as well as to make storage tanks, ships, aircraft parts, and many other types of equipment.

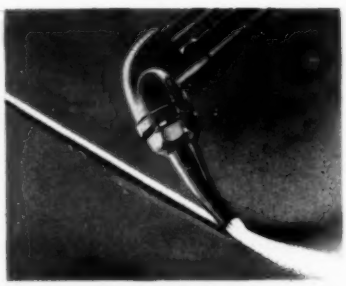
CUTTING PIPE



Beveling Pipe – The ends of pipe to be joined by welding must be cut uniformly—and, whenever the walls are more than 3/16 in. thick, the ends must be beveled to make possible complete weld penetration. This work is done quickly by oxy-acetylene cutting, using mechanized or manual equipment.

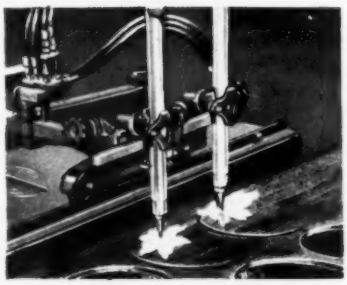


Cutting Pipe Rounds – Oxy-acetylene machines like this cut billets to length; others gouge starting holes for piercing to make seamless pipe.



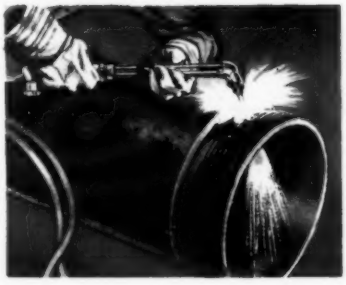
Gouging – Cutting blowpipes equipped with gouging nozzles quickly remove surface metal, such as temporary welds, without harm to adjacent areas.

Tube Welding – In making welded tubing, edges of steel strip moving at high speeds through forming rolls are joined by oxy-acetylene flames.



Fabricating Flanges – Flame-cutting machines quickly and accurately produce pipe flanges of any size or thickness from stock steel plate.

Preparing Plate-Edges – Flame-cutting equipment speeds trimming and beveling of plate preparatory to welded fabrication of large-diameter pipe.

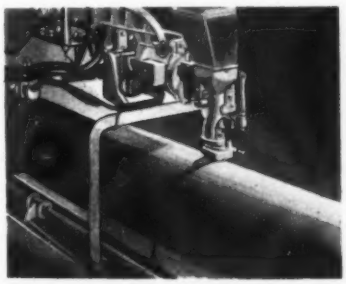


Reclaiming, Altering – Flame-cutting speeds on-the-job reclamation of old pipe, and extension or alteration of existing piping systems.

are important in the Production and Fabrication of Pipe

JOINING PIPE

Pipe Welding – Piping systems that are strong, compact, leak-proof, and practically maintenance-free can be fabricated into an integral unit by oxy-acetylene welding. The smooth interior and exterior walls of flame-welded piping provide high flow efficiency and make insulation easier where this is required.



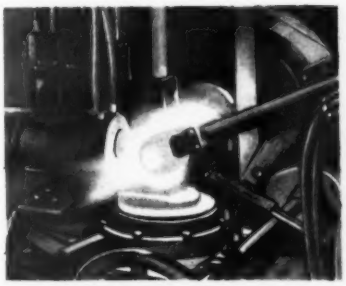
Double-Lengthing – Joining pipe into long lengths at a central location reduces manual welding work in the field. Here it is being done by the UNIONMELT automatic electric process.

Fabricating Fittings – Oxy-acetylene welding, used with flame-cutting, makes it possible to produce fittings from stock pipe at low cost, as needed.

Joining Copper Tubing – Air-acetylene torches provide the exact amount of controlled heat for installing copper tubing and solder-type fittings.

FORMING AND TREATING

Flame-Hardening – Oxy-acetylene flames, followed by a water quench, impart a hard, wear-resistant case to surfaces of carbon or alloy steel. Here, this process is being applied to the tool joints of oil well drill pipe. It also is used on such parts as gears, shafts, and other parts subjected to abrasive wear.

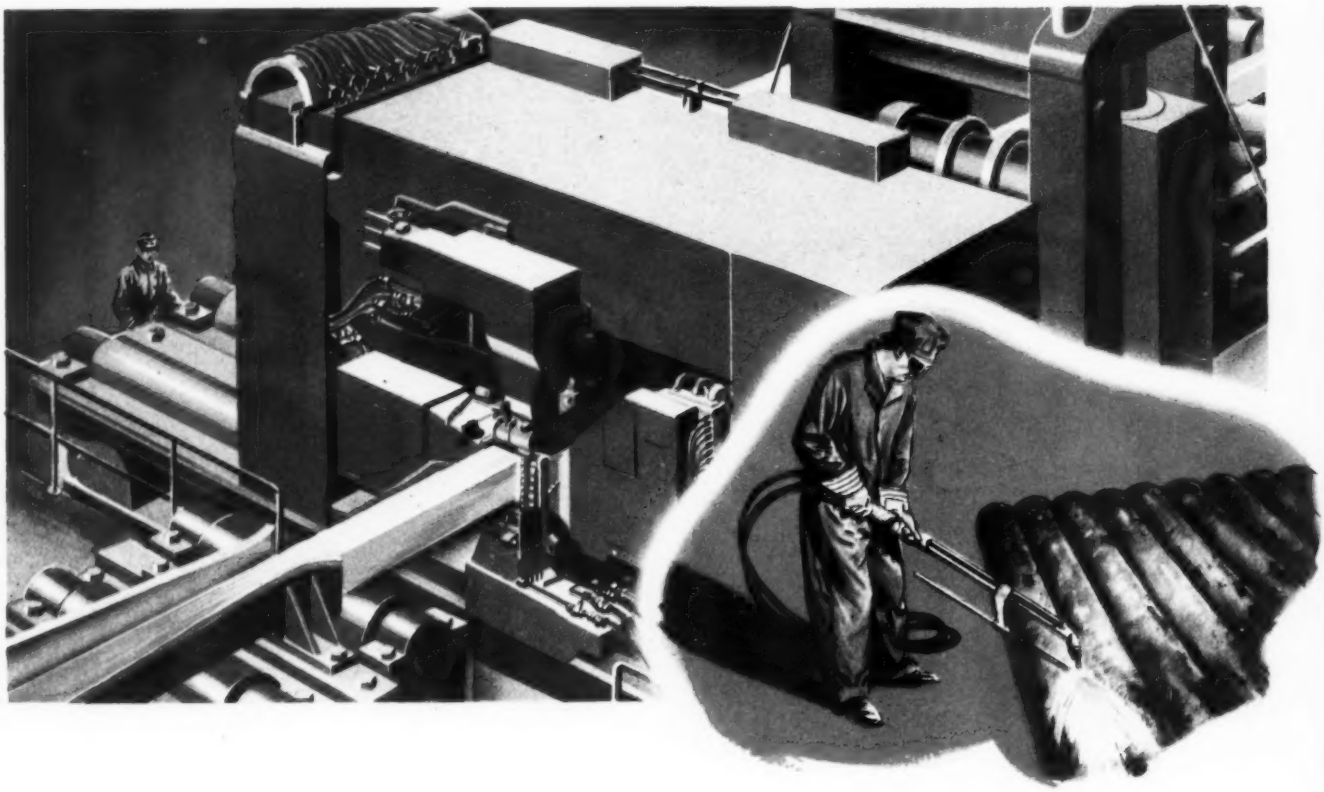


Flame-Spinning – Tubing heated by oxy-acetylene flames while spun rapidly can be quickly end-formed to eliminate deep-drawing operations.

Flame-Priming – Oxy-acetylene flames remove scale, rust, grease, and moisture from surfaces of pipe, tanks, and other steel preparatory to painting.

Flame-Straightening – Bent steel pipe, shafts, girders, or plates often can be trued up by applying oxy-acetylene flames at the right points.

LINDE METHODS SPEED PRODUCTION OF QUALITY STEEL USED FOR MAKING PIPE AND MANY OTHER PRODUCTS



A good example of how Linde-developed methods, based on the same principles as some of those shown on the three preceding pages, can be applied to fit specific needs of an industry is in the conditioning of semifinished steel. Oxy-acetylene flame-scarfing equipment, specially developed for steel mills, literally "skins" surface defects from billets, blooms, and slabs. This is done either as the steel rolls through on the production line by huge Linde machines such as the one shown above, or—after it has cooled and been removed from the roll table—by manually operated deseaming blowpipes as shown in the small drawing. This metal treatment results in higher yields of quality steel. In all industries where metal is worked, Linde methods can usually help to do the job faster, better, and at lower cost.

The folders shown at the left tell the story of the use of Linde methods in SHIPBUILDING, in STEELMAKING, and in METAL-FABRICATING. Copies will be sent to you upon request. Ask for Combination "A."

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Unit of Union Carbide and Carbon Corporation

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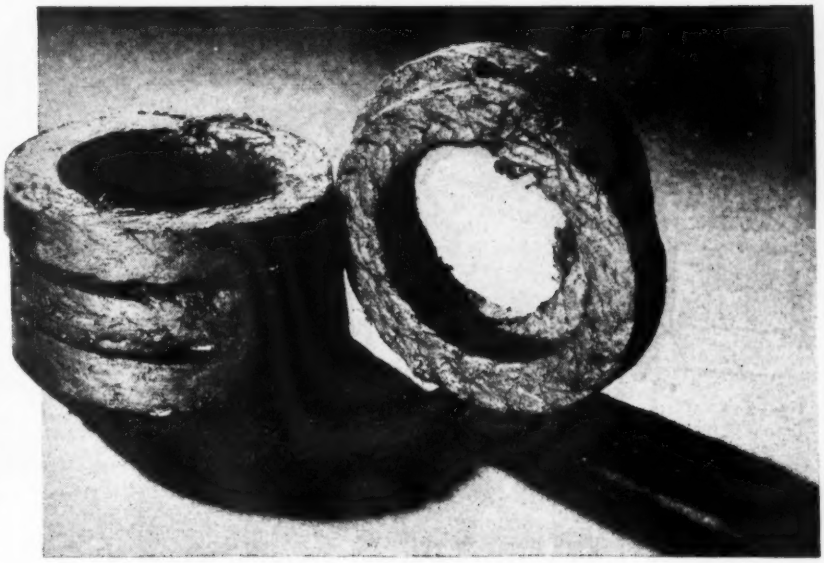
[PUMP TIPS FROM ALLIS-CHALMERS—ONE IN A SERIES]

How to make PACKING Last Longer . . .



The *kind* of packing and *how* you use it have a lot to do with maintaining peak pumping efficiency. Here, at left, is a step-by-step outline of the correct way to install pump packing — saving you vital man-hours and money as well.

MOST PACKING TROUBLE traces back to *lack of "know-how"* in caring for stuffing boxes. This is wasteful — time and money-wise — especially since *correct* packing procedure is so simple for maintenance men to understand and practise.

Another class of trouble traces to misalignment of pump and motor. For when shaft is deflected, sleeve is apt to wobble — greatly accelerating packing wear. To eliminate this problem, A-C engineers developed, for many applications, the "Electrifugal" pump — in which both motor and impeller are mounted on *one* shaft, in *one* frame. This means fewer parts, fewer bolted connections — no chance for misalignment.

Regardless of type of pumps you use, here is an outline of correct packing procedure — plus a few tips on what to look for when trouble *does* arise . . .

▸Make certain packing is suitable for service it must perform . . . that it's the right size and made of the right materials. Be cautious of so-called "all-purpose" packings. If in doubt, check with your pump manufacturer.

▸Don't force in new packing against the old. It's apt to displace lantern ring and plug sealing liquid opening. First remove *all* old packing; clean stuffing box thoroughly; then insert new packing.

▸Put each ring of packing in separately, seating it firmly before adding the next. Stagger adjacent rings so that joints are at 180° angle to each other. If lantern rings are used, be careful that sealing liquid openings aren't blocked as new rings are installed.

▸After required number of rings have been inserted, tighten gland nuts. Gland should be taken up evenly to *finger-tightness*. If compressed too tightly, packing will burn out or sleeves become scored.

▸Finally, until shaft turns over freely, operate pump for about 1-minute intervals — permitting packing to cool. Then put it into continuous operation.

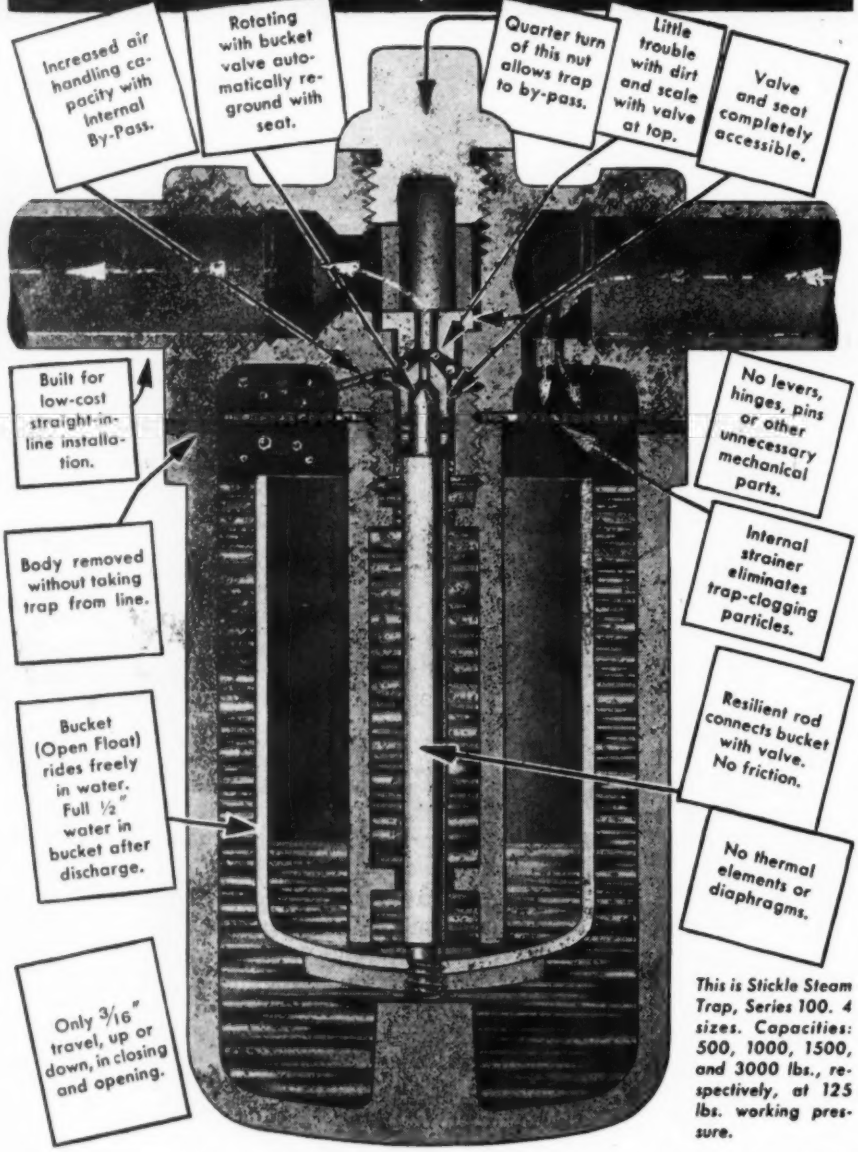
▸What to check for if packing wears too quickly — (1) Check shaft sleeves. If badly scored they grind down packing rapidly; (2) Check position of lantern ring. It may be displaced; (3) If water seal piping is used, check liquid. If it contains grit a separate source of sealing liquid should be obtained.

▸Send for your *free* copy of Allis-Chalmers' "Handbook for Wartime Care of Centrifugal Pumps". It's the basic, easy-to-understand guide to efficient centrifugal pump maintenance. Contains *no* advertising; applies to *all* makes. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 1754

ALLIS-CHALMERS PUMPS

Allis-Chalmers builds all types and variations of pumps shown at right. Capacities from 10 to 150,000 gpm—heads to 2500 lbs.

Tomorrow's BETTER STEAM TRAP *is already available*


Increased air handling capacity with internal By-Pass.
Rotating with bucket valve automatically re-ground with seat.
Quarter turn of this nut allows trap to by-pass.
Little trouble with dirt and scale with valve at top.
Valve and seat completely accessible.
Built for low-cost straight-in-line installation.
No levers, hinges, pins or other unnecessary mechanical parts.
Body removed without taking trap from line.
Internal strainer eliminates trap-clogging particles.
Bucket (Open Float) rides freely in water. Full ½" water in bucket after discharge.
Resilient rod connects bucket with valve. No friction.
No thermal elements or diaphragms.
Only 3/16" travel, up or down, in closing and opening.

This is Stickle Steam Trap, Series 100. 4 sizes. Capacities: 500, 1000, 1500, and 3000 lbs., respectively, at 125 lbs. working pressure.

● The basic Stickle Open Float principle of construction is available in the complete line of Stickle Steam Traps. In series designs for operating with high, medium and low pressures and with vacuum systems. Sizes in each series for required capacities. The accumulated knowledge supplied by 40 years of specialization in drainage and control for increased operating efficiency and decreased cost of steam is incorporated in Stickle Traps.

Ask for special Bulletin giving complete information and data. State working pressure and operating conditions for recommendations.

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STEAM SPECIALTIES COMPANY

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SPECIALIZING FOR 40 YEARS IN REDUCING THE COST OF STEAM

New Bulletins

(*Continued from page* 174)

16 **TUBING TOOLS**—Imperial Brass Mfg Co, 1200 W Harrison St, Chicago 7, Ill. Form No. 299 and bulletin No. 337 list tools for cutting, flaring, bending, coiling, pinchoff, swedging, soldering, reaming, rethreading and refacing.

17 **SAFETY VALVES**—J E Longergan Co, 2nd and Race St, Philadelphia 6, Pa. 8-page bulletin No. 501-A is an interpretation of new safety-valve standards developed under WPB and National Bureau of Standards. Tables summarize sizes, connections, service limits and other standard specifications for each valve.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **FORGED STEEL FLANGES**—Ladish Drop Forge Co, Cudahy, Wis. Catalog supplies descriptions and specifications for controlled-quality forged-steel flanges and contains engineering information, conversion tables and performance data, as well as ASA tables on wartime pressure ratings.

PRIME MOVERS AND ACCESSORIES

18 **DIESEL ENGINES** — Caterpillar Tractor Co, Peoria, Ill. 16-page form No. D43, entitled *The Caterpillar Diesel Way*, illustrates the special features of tractors, motor graders and engines. Seals and filters, the fuel system, lubricating oil and water cooling systems, starting engines and other features are shown.

19 **MECHANICAL-DRIVE TURBINES**—Steam turbine dept, Elliott Co, Jeannette, Pa. 4-page bulletin No. H15 discusses CY single-stage mechanical-drive turbine with built-in reduction gear.

20 **STEAM TURBINES** — Terry Steam Turbine Co, P O Box 1200, Hartford 1, Conn. 4-page bulletin No. S-140 describes complete line of single-stage and multi-stage steam turbines.

WELDING

21 **ANTISPATTER FLUID** — Midland Paint and Varnish Co, 9115 Reno Ave, Cleveland 5, Ohio. 6-page bulletin reports practical and scientific tests to determine the effects of using an antispatter fluid in welding. Booklet contains laboratory reports on weld strength and soundness and fume suppression.

22 **WELD TIMER CONTACTOR**—Weltronic Co, 19500 W 8 Mile Rd, Detroit 19, Mich. Bulletin No. WTTC-44 details specifications, features and applications of combination timer-contactor *package* units, designed to provide the simplest, lowest cost, automatic electronic control for resistance welders.

23 **REDUCTION REGULATORS**—Victor Equipment Co, 844-54 Folsom St, San Francisco, Calif. 16-page form No. 40 illustrates design and construction features of Victor single and two-stage reduction regulators employed in the welding industry for welding, cutting and allied flame applications.

24 **SEAM WELDER CONTROLS**—Weltronic Co, 19500 W 8 Mile Rd, Detroit 19, Mich. Bulletin No. WT-40-41 covers application, operation, description, specifications and features of improved full-electronic seal-welder controls.

25 **METAL JOINING**—Handy & Harman, 82 Fulton St, New York 7, N. Y. *Low-Temperature Brazing News* No. 27 covers the use of *Sil-Fos*, *Easy Flo* and *Easy-Flo No. 3*.

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● If you are interested in reducing your pumping costs, send for the new 8-page Bulletin just off the press.

A Pumcup is a unique, composition cup which replaces the usual ordinary packing on the piston of a reciprocating pump or hydraulic control mechanism. Pumcups have proved their value in hundreds of plants, in varied types of service, over a period of 35 years. Some users report savings on pump packing and maintenance of as much as $100 per pump per year.

This new Bulletin gives you complete information about Darcova Pumcups—what they are, how they are applied, the principle of their operation, fluids pumped, sizes, reports of actual users, and other information important to all users of reciprocating pumps and hydraulic controls. Ask for your copy now—just a note on your letterhead or the coupon below will bring it.

DARCOVA
THE ORIGINAL COMPOSITION CUP

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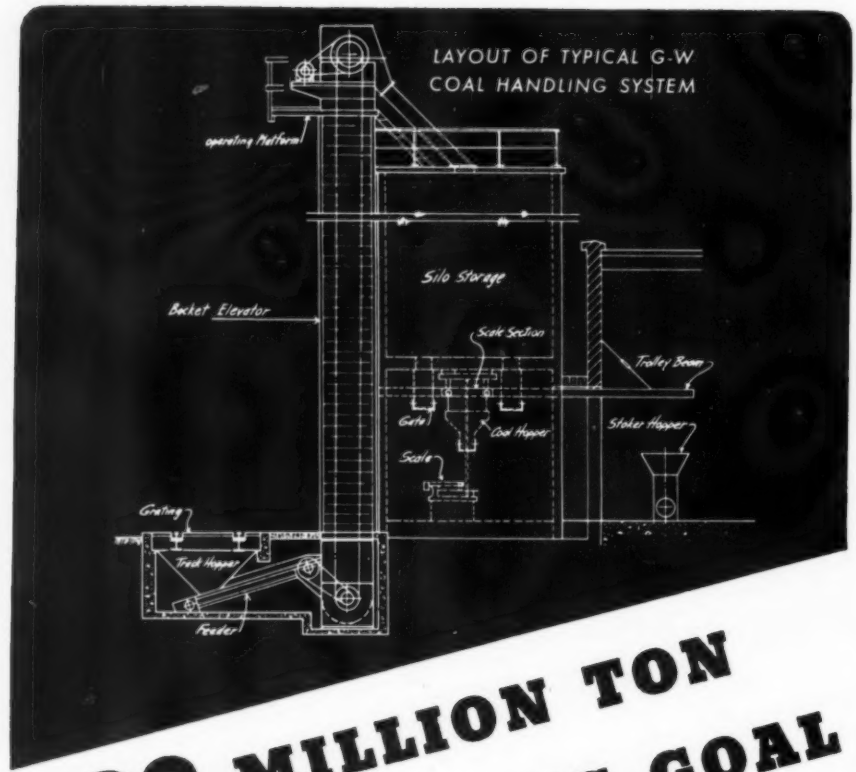

A 29 MILLION TON COAL-SAVING GOAL

The National Fuel Emergency Council has undertaken a drive *by* industry and *for* industry to help stretch our fuel supply. Their coal-saving goal this year is *29,000,000 tons.* Success will avert a disastrous fuel shortage—success will avoid curtailment of war industries and allocation of fuel—success will speed Axis defeat.

G-W believes that every man in industry will lend his fullest cooperation in furthering the National Fuel Efficiency Program, by checking every possibility in his own plant for furthering economies in power generation—right on down to the receiving of coal and its delivery to boilers or pulverizers.

As designers and builders of coal storage and coal and ash handling systems for over 130 years, Gifford-Wood stands ready to cooperate with you to the fullest. Standard and special designs—or combinations—to meet individual requirements will gladly be adapted by G-W engineers in consultation with your Engineering Dept. Catalog P-200 will also be a big help with its 120 pages of pictures, drawings, tables and Engineering data. Write for your copy today.

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OTHER EQUIPMENT

26 REFRIGERATION—Imperial Brass Mfg Co, 1200 W Harrison St, Chicago 7, Ill. Catalog No. 88-L includes refrigeration and air-conditioning valves, fittings, service tools, dehydrators and allied items.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **THERMAL CONTROL**—Fenwal Inc, 200 Pleasant St, Ashland, Mass. 44-page Fenwal Thermoswitch catalog describes temperature and pressure control apparatus.

27 COMBUSTION CONTROL—The Engineer Co, 75 West St, New York 6, N. Y. 6-page bulletin No. BD44 stresses importance of simplicity and coordination in combustion control in a modern power plant. Three Enco units are recommended: Enco balanced-draft furnace regulator, steam pressure regulator and stoker speed control.

28 MOTOR DRIVES — Weltronic Co, 19500 W 8 Mile Rd, Detroit 19, Mich. Bulletin No. WTM-44 presents electronic, adjustable-speed motor drives, which operate any dc shunt-wound ½- to 15-hp motor from ac power supply, for lathes, grinders, drill presses, conveyors, winches, printing presses, etc.

29 CONSTANT - VOLTAGE TRANSFORMERS—Sola Electric Co, 2525 Clybourn Ave, Chicago 14, Ill. Bulletin No. CV-102 describes built-in transformers for electronic equipment not requiring filament voltmeters or manual controls.

30 INSULATION WORK — Building materials div, Armstrong Cork Co, Lancaster, Pa. *Armstrong's Insulator*, for past thirteen years a 4-page newspaper, reporting Armstrong insulation work, has been converted to a magazine format, 16 pages, illustrated. Current edition contains the following articles: "Locker Plants" "How Foamglas is Made," "Stratosphere on the Ground."

31 MINERAL WOOL—Industrial Mineral Wool Institute, 441 Lexington Ave, New York, N. Y. Commercial Standard CS117-44, entitled *Mineral Wool; Blankets, Blocks, Insulating Cement and Pipe Insulation for Heated Industrial Equipment*, issued by National Bureau of Standards, covers requirements for Mineral Wool insulating materials and illustrates approved methods of installation.

32 COAL-MOVING RIG—LeTourneau, Peoria, Ill. Folder No. TP-118 describes Model D *Tournapull* for loading hauling and spreading industrial and institutional coal piles, etc.

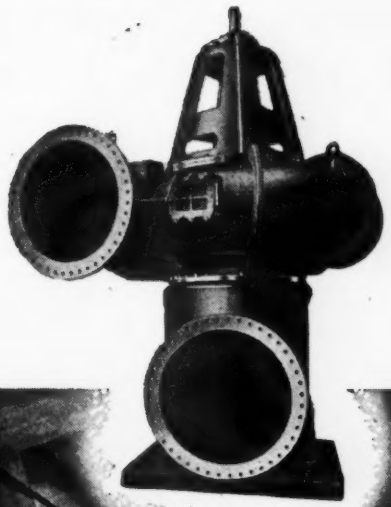
33 PUMP CUPS—Darling Valve & Mfg Co, Williamsport, Pa. 8-page booklet introduces *Pumcups*, composition cups for repacking pistons of all reciprocating pumps or hydraulic mechanisms. Pamphlet points out how pump operators can benefit from repacking pistons with *Darcova Pumcups.*

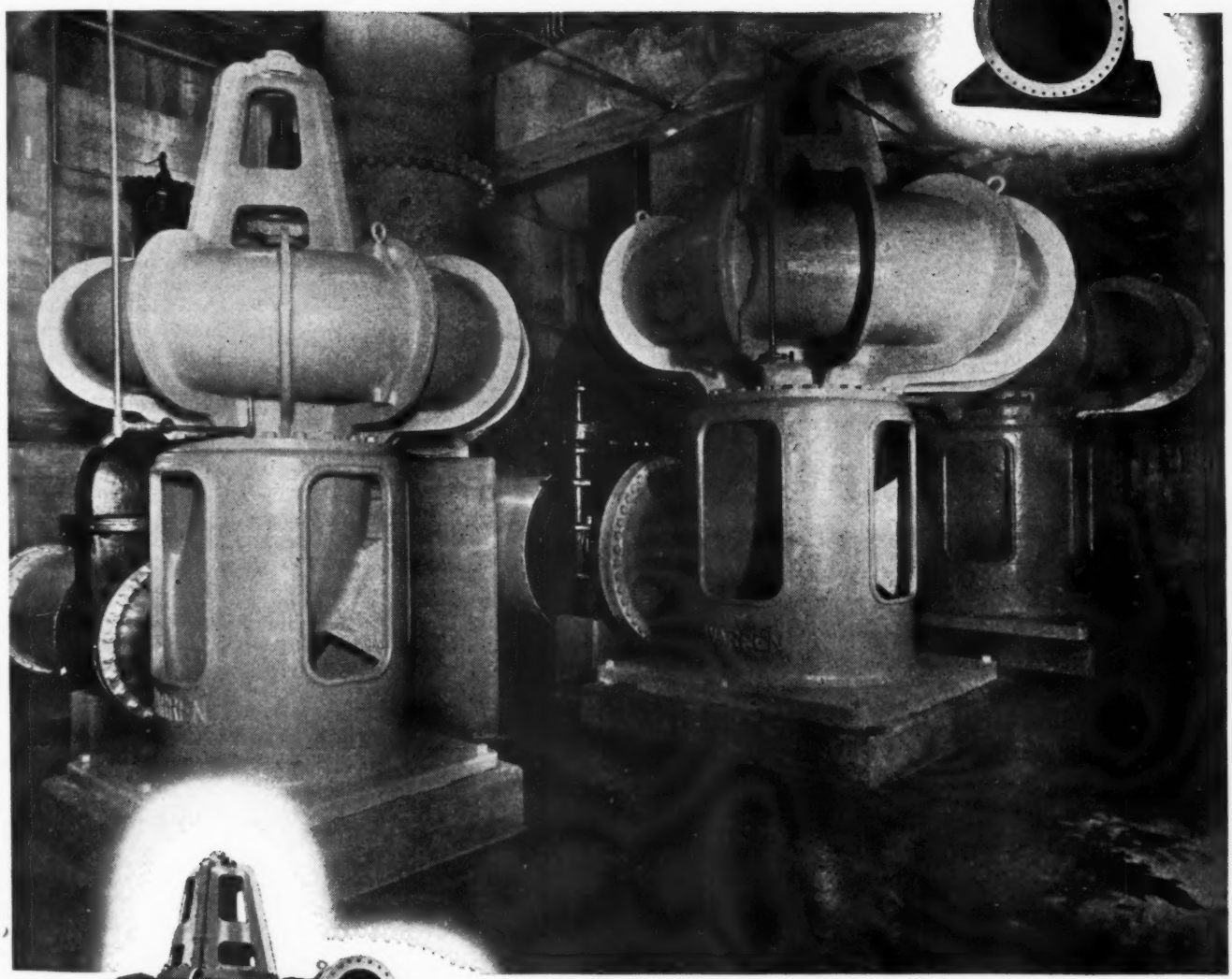
34 CALCIUM-CARBONATE SCALE—National Aluminate Corp, 6216 W 66th Pl, Chicago 38, Ill. 8-page booklet, entitled *A New Index for Determining Amount of Calcium Carbonate Scale Formed by a Water*, is a reprint from *Journal of the American Water Works Association.*

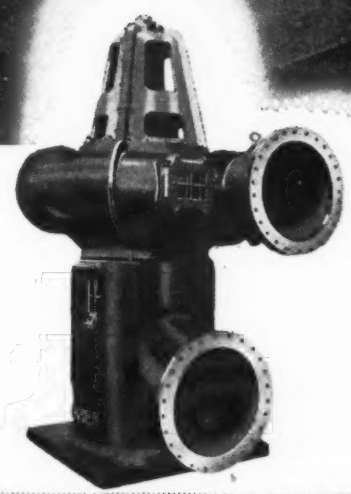
35 WIRE PRODUCTS—Wickwire Spencer Steel Co, 500 Fifth Ave, New York 18, N. Y. 32-page booklet, entitled *Let's Take a Tour with Wick and Spen*, lists various wire products manufactured by company.

36 CHEMICAL SERVICE—Gilbert Associates, Inc, 23rd and Fairview St, Mt Penn, Reading, Pa. 22-page bulletin describes Gilbert chemical laboratory service and includes: anthracite and bituminous coal analyses, lubricating- and fuel-oil analyses, chemical analyses of industrial waters, bacteriological analyses of potable waters, miscellaneous analyses and tests and water-treatment engineering.

PUMPS AGAINST THE RIVER AT SPRINGFIELD







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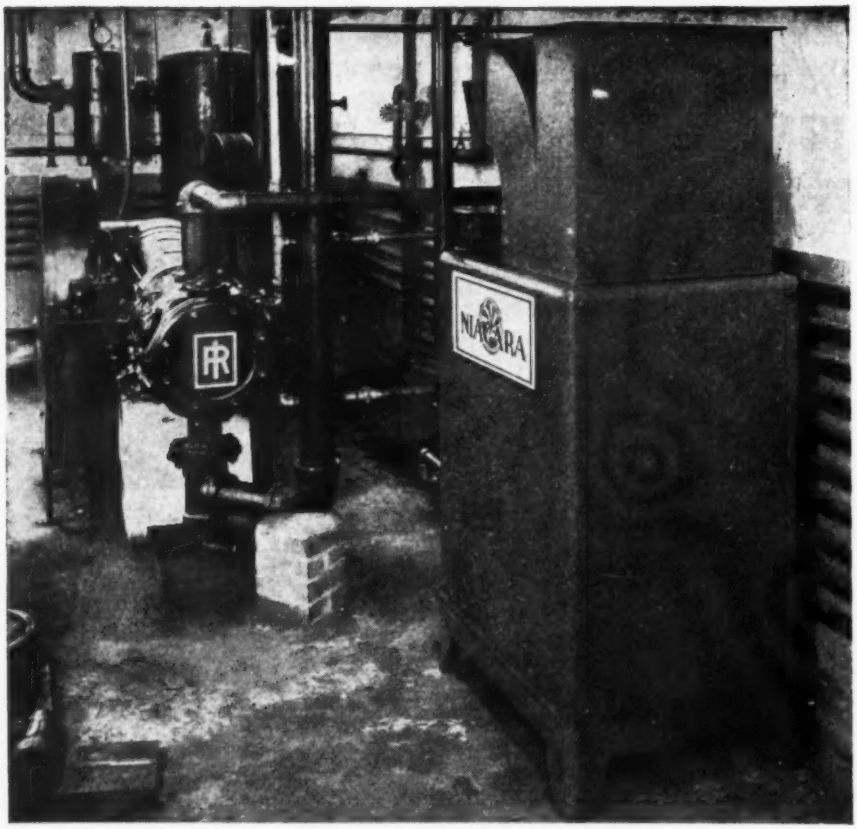

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Engineer's Books

(*Continued from page* 128)

It does not attempt to develop new theories nor to cover advanced ones, but presents basic principles of design, construction and application along conventional lines of present-day practice.

Examples are worked out to clarify the text, and problems with answers are given by which the reader may test his grasp of the subject. The text is divided into three sections: (1) Theory, which covers principles of fluid flow, basic theory of pumps and blowers and thermodynamics (2) Centrifugal pumps, dealing with specific speed and efficiency, performance curves and cavitation, design, materials, application and selection, installation and test. (2) Centrifugal blowers, treating of performance curves, design, construction and application, installation and regulation, operation and test, disk stresses and shaft critical speed. Engineers interested in centrifugal pumps and blowers will find this a valuable addition to the literature on these subjects.

Refractory Materials

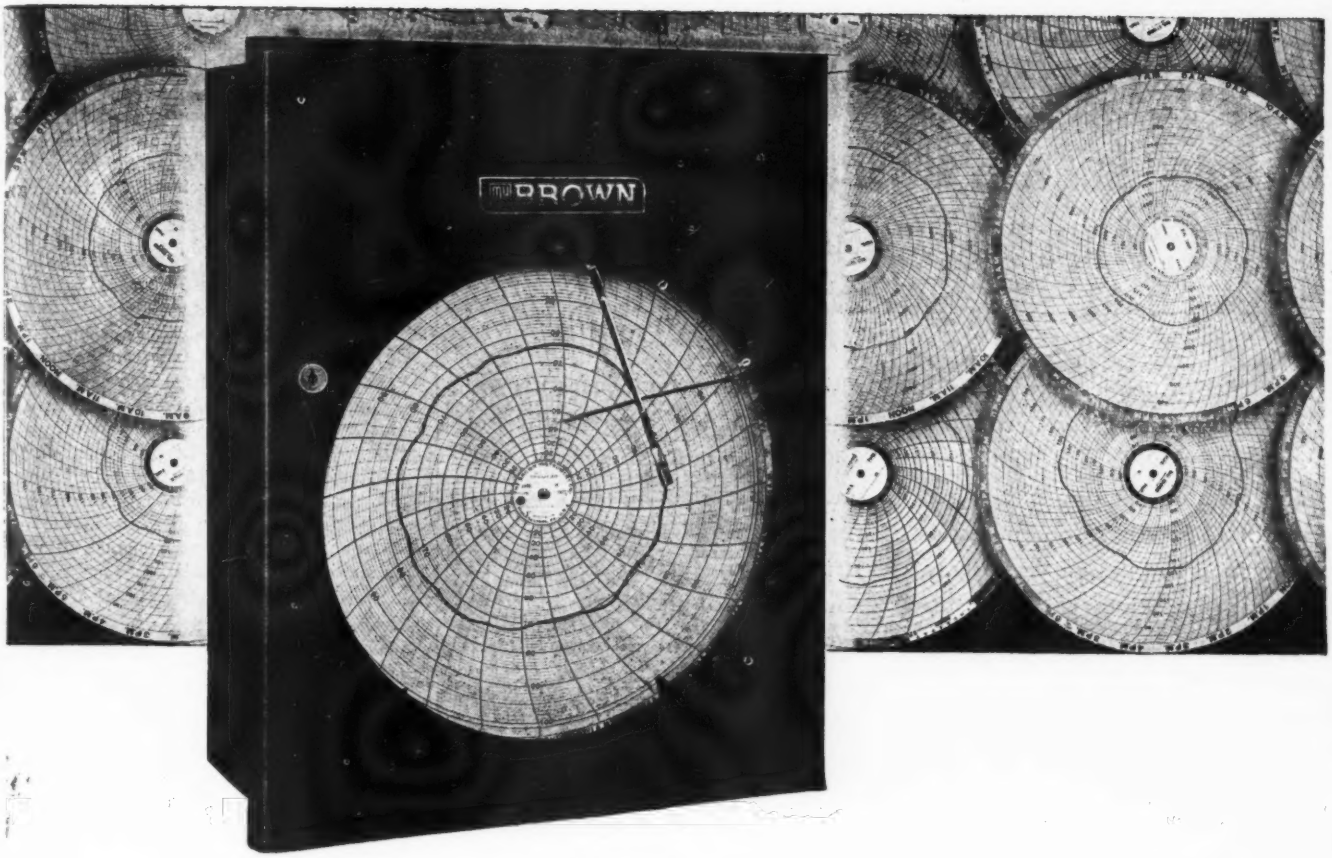
MANUAL OF ASTM STANDARDS ON REFRACTORY MATERIALS. *Prepared by ASTM Committee C-8 on Refractories. Published by the American Society for Testing Materials, 260 S Broad St, Philadelphia, Pa.,* 210 *pp, paper* $1.50, *cloth* $1.75, *special rates on quantity orders.*

This manual gives new standards for air-setting refractory mortars, fireclay plastic refractories for both boiler and incinerator services. Included are methods of test for measuring shrinkage, spalling, and workability index of fireclay plastic refractories, and a method for measuring thermal conductivity of insulating firebrick.

Electronics

ELECTRONICS: TODAY AND TOMORROW (1944) *By John Mills, Sometime Member Technical Staff, Bell Telephone Laboratories. Published by D Van Nostrand Co, 250 4th Ave, New York, N. Y.* 178 *pp,* 5½x7½, *illustrated,* $2.25.

Electronics have stimulated many technical authors, and some not so technical, into writing for the novice or near novice. Their books may be divided into two classes: those that give detailed instruction on construction and operation of electronic equipment, and those that give general information in popular style. This little book, one of the best in the latter class, comes from the pen of a scientist who writes in a pleasing style. So whether you are looking for electron information or just want to be entertained by reading good English written around facts, try this book. Its 16 chapters are: new sciences for old, lightning of nature, man-made lightning, hot cathodes, diodes and rectifiers, De Forest's audion,



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Air Temperatures at preheaters
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Gas Temperatures at preheaters
Gas Temperatures at economizers
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Water Temperatures at economizer

AN economizer should live up to its name . . . that is, properly conserve heat energy of the boiler exit gases.

The more efficient the economizer, the lower your fuel bill will be. That the economizer is a means of reducing the cost of generating steam is well known to users of Brown Thermometers. Where they are installed, users have an accurate means of checking gas and water temperatures entering and leaving the economizer. The chart records enable them to attain maximum boiler operating efficiency.

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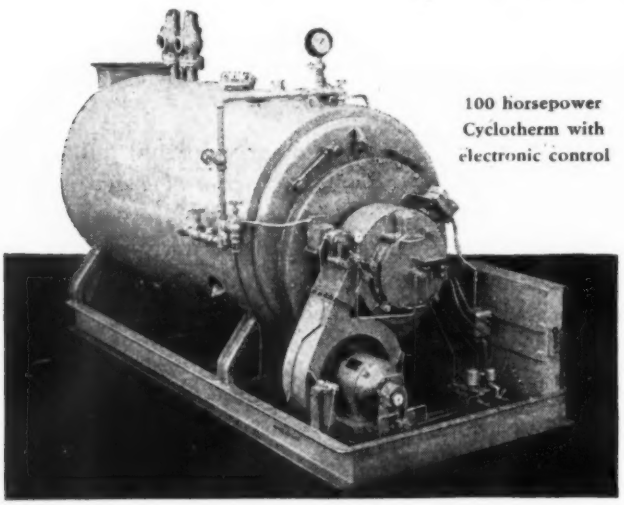

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Booklet Reviews

SAFETY IN ELECTRIC AND GAS WELDING AND CUTTING OPERATIONS. *American Standards Assn, 29 W 39th St, New York 18, N. Y.*, 32 pp, 40¢ *single copy, special rates on quantity orders.*

Here is a guide for the protection of the individual operator from injury or illness, and of property from fire or other damage arising from improper methods in the installation, operation or maintenance of welding and cutting equipment.

LIGHTNING ARRESTER STANDARDS; *Publication No. 44-89 of National Electrical Mfrs Assn, 155 E 44th St, New York, N. Y. 36 pp,* 8½x10, $1.00. This reference manual of standards provides practical information concerning the manufacture, test and performance of lightning arresters.

MINING AND INDUSTRIAL LOCOMOTIVE STANDARDS; *Publication No. 44-96 of National Electrical Mfrs Assn, 155 E 44th St, New York, N. Y. 23 pages,* 8½x10, 75¢. This manual gives information on (1) *mine locomotives:* trolley, storage-battery and combination types and (2) *industrial locomotives:* trolley, third-rail, storage-battery and combination types.

CANADA WATER-POWER WEALTH (1944) *By J T Johnston. Published by Canadian Geographic Society, Ottawa, Ont., Canada. 40 pp, 7x10½, profusely illustrated, paper binding.* A general description of Canada's more important water-power developments, it provides a useful source of information for those interested in that country's hydroelectric possibilities.

CONSTRUCTION, CARE, AND USE OF PERMISSIBLE FLAME SAFETY LAMPS *Prepared by A B Hooker, Assoc Elec Engr, Bureau of Mines' Experiment Station, Pittsburgh, Pa. Miners Circular 44, Available from Supt. of Documents, U. S. Govt Printing Office, Washington 25, D. C.* 10¢. Report describes Koehler and Wolf lamps, often needed in power-plant work, for detecting explosive gas and deficiencies of oxygen in atmospheres.

SOLUTION OF VIBRATION PROBLEMS BY USE OF ELECTRICAL MODELS (1944) *By C R Freberg, Asst Prof, Mechanical and Aeronautical Engineering, Purdue University. Published by Purdue University, Lafayette, Ind. 42 pp, 6x9, paper binding.*

Highly mathematical, this publication gives results of an investigation undertaken primarily to show how to solve mechanical vibration problems by setting up equivalent electrical circuits on which measurements can be made to determine the behavior of

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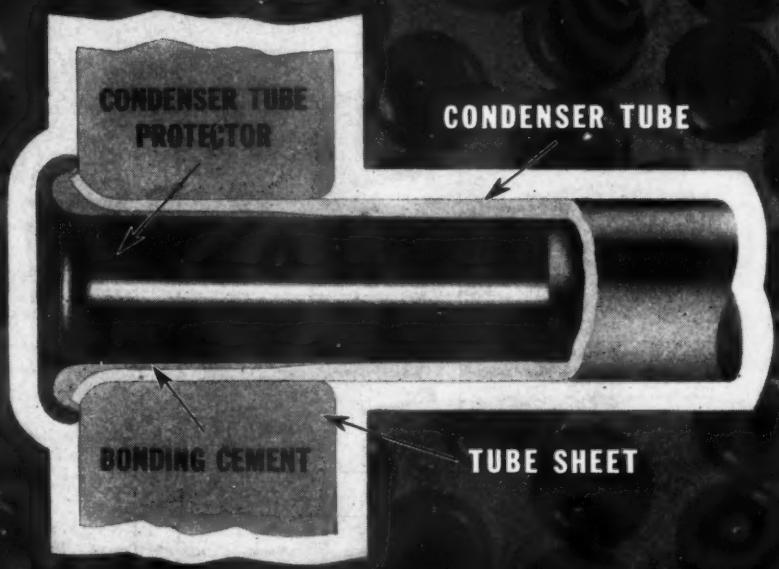
Condenser Tube Protectors



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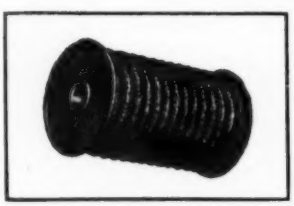

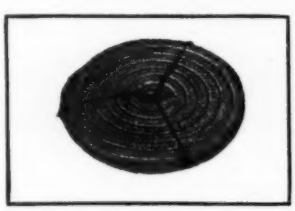

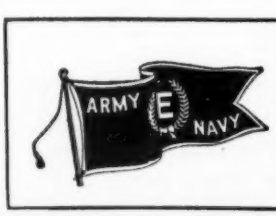

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the mechanical system. The results show that reasonable values of inductance, capacitance and resistance can be used and that practical difficulties in the design of the electrical system can be overcome.

THE BURNING RATE OF BLASTING FUSE *By D Harrington, Chief, Health and Safety Service, and R G Warncke, Mining Engr. Washington, D. C. Information Circular* 7281. *Available on request to Bureau of Mines, Dept of Interior, Washington* 25, *D. C.* Publication describes fuse burning rate and contains precautions for avoiding premature blasts. Circular also discusses accidents caused by these blasts.

THE T V A LESSONS FOR INTERNATIONAL APPLICATION (1944) *By Herman Finer. Published by International Labour Office,* 3480 *University St, Montreal, Canada.* 289 *pp,* 6¼x9¼, $2. This book, written largely from the social angle, analizes the T V A intentions, plans and history in terms of similar proposed projects in other countries.

TEMPERATURE DROP IN DUCTS FOR FORCED-AIR HEATING SYSTEMS *By Alonzo P Kratz, Seichi Konzo and Richard B. Engdahl. Bulletin No.* 351. *Engrg Experiment Station, Urbana, Ill.* 64 *pages,* 6x9 *in. Available on request.* Results of an investigation to study heat loss from galvanized iron ducts carrying heated air and to determine resulting drop in temperature in air flowing in ducts.

Power News

(*Continued from page* 134)

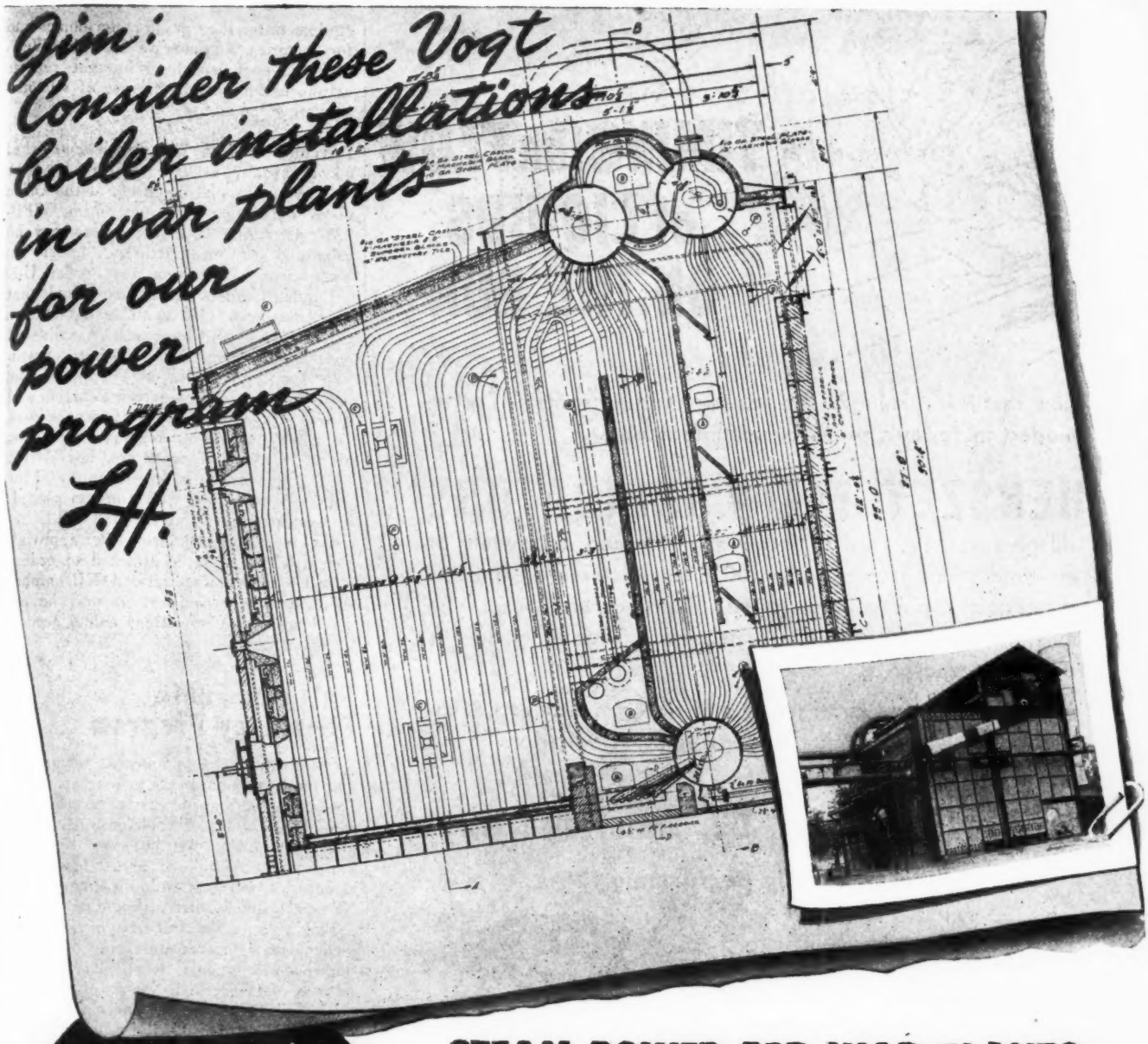
contractors, heating-equipment installers, distributors and dealers of stokers and stoker manufacturers. These people have the everyday job of matching and applying stokers to various types, kinds, sizes and designs of boilers and furnaces, which burn various types and ranks of bituminous and anthracite coals.

To produce silicones—materials of far-reaching industrial importance in a new field of chemical manufacture—sand, brine, coal and oil are providing the basic elements. At a luncheon in New York City, executives of Corning Glass Works and The Dow Chemical Co gave details of the new products' development by Corning and Dow scientists.

In revealing the performance of the first commercial production of these silicones, W R Collings, vice-president and general manager of Dow Corning Corp, stated that they are the result of a century's research to use silicon and oxygen, the elements of which sand is composed, in the production of new temperature-resistant materials. Among the most important of these silicone materials are high-temperature insulating resins, but silicones can be produced either as solids or liquids in an infinite variety of forms.

Silicone chemistry makes possible the building of lighter and better electrical

Jim: Consider these Vogt boiler installations in war plants for our power program
L.H.



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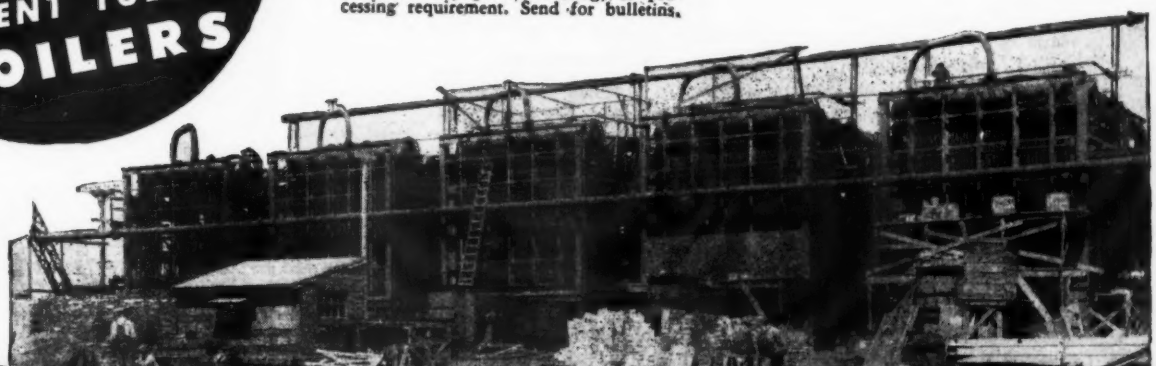

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How fast is it running? The answer to that problem is often needed in today's precision manufacturing.

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will give you the rate of flow—instantly and accurately at any time. Flow from zero to 100% is registered on the dial of uniformly spaced graduations. Readings are direct—no constants or transcribing are necessary. Pulsating flow is recorded exactly as it occurs.

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Sizes range from 10 G.P.M. to 600 G.P.M. Pipe connection ¾" to 4". Indicator body made of special dense bronze in sizes up to and including 100 G.P.M. Larger bodies made of cast iron. Indicators can be furnished of nickel, cast steel, stainless steel or other desired alloys.

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equipment for the war effort, for homes and for factories. Exhaustive tests by Westinghouse engineers have brought reports of unusual success in the use of silicone-insulating materials.

Purchase orders for transformers of 5-kva capacity or less will have to be cleared by regional engineers of the Office of War Utilities on a new form, WPB-3782, after Aug 15 before orders may be submitted to manufacturers, under an amendment to direction 1 to order U-1.

Purchase orders already validated that have not been filed with manufacturers before Aug 15 will have to be re-validated on the new form, OWU officials warned. The form will help OWU control the limited stocks of these transformers, and it will cut down excess of orders over validations given by regional engineers. Since direction 1 was instituted last March, 22,000 transformers have been approved for purchase, as against 34,000 orders placed.

Duplicate copies of WPB-3782 will be returned by regional engineers after approval, one of which must be attached to orders placed with manufacturers. OWU emphasized that these transformers may be ordered only on AA-3 ratings unless needed for emergencies.

National Fuel Efficiency Program

Secretary Ickes again urged commercial and industrial consumers to take an active part in the nationwide campaign to stretch available supplies of coal, gas, petroleum and other fuels. At the same time, he announced appointment of 26 new additional area coordinators in 19 states in the National Fuel Efficiency Program.

Following in the footsteps of 75 previously named coordinators, the new appointees will organize local advisory committees and direct the work of regional engineers. With the assistance of Bureau of Mines' fuel experts, the program's goal is to minimize fuel losses in industrial and commercial establishments.

In addition to the new coordinators, Dr R R Sayers, director of the Bureau, announced that two district engineers of the fuel efficiency section have established offices in Midwestern cities to serve as liaison men between area coordinators. They are Arlen Z Jennings, Chicago, and John G Mingle, Indianapolis. Appointment was also announced of Raymond C Johns, vice-president in charge of research for Anthracite Industries, Inc, as a member of the National Fuel Efficiency Council to succeed Harold J Rose.

Commercial and industrial establishments, such as blast furnaces, factories, plants, office buildings and apartment houses, are among the largest users of fuels. If they reduce consumption through more efficient fuel use, it will go a long way toward bridging the gap between estimated production and consumption of coal this year and alleviating an expected "tight" situation in gas, petroleum and other fuels.

Coal shortage for the next twelve months will be about 21 million tons. If the NFEC goal is attained, it will mean

THERE'S NO ELIXIR TO CURE YOUR CLEANING PROBLEMS

IT'S REALLY *pH* THAT DOES THE JOB!

Kelite has developed scientific cleaning and processing through pH Control. pH Control is the "yardstick of chemistry." Just as degrees Fahrenheit are a measurement of temperature, or inches a measurement of lineal distance, or pounds a measurement of weight—so pH is a measurement of cleaning effectiveness when used in the copyrighted Kelite method.

Soil, grease, corrosion, paint, fruit stains, yes, in fact every substance in the universe has a definite location on the Kelite pH chart. Thus it is simple to select a material of correct pH value to reduce contamination to a neutral state, or to break the adhesion of an undersirable coating, or to dissolve a substance so that it may be easily rinsed away.

Every Kelite Service Engineer is equipped to do pH testing right in your plant. His demonstration may seem like sheer magic to you, but he is really only applying a modern scientific principle to the age-old problem of cleaning.

Kelite invites your inquiry.

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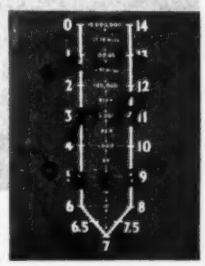

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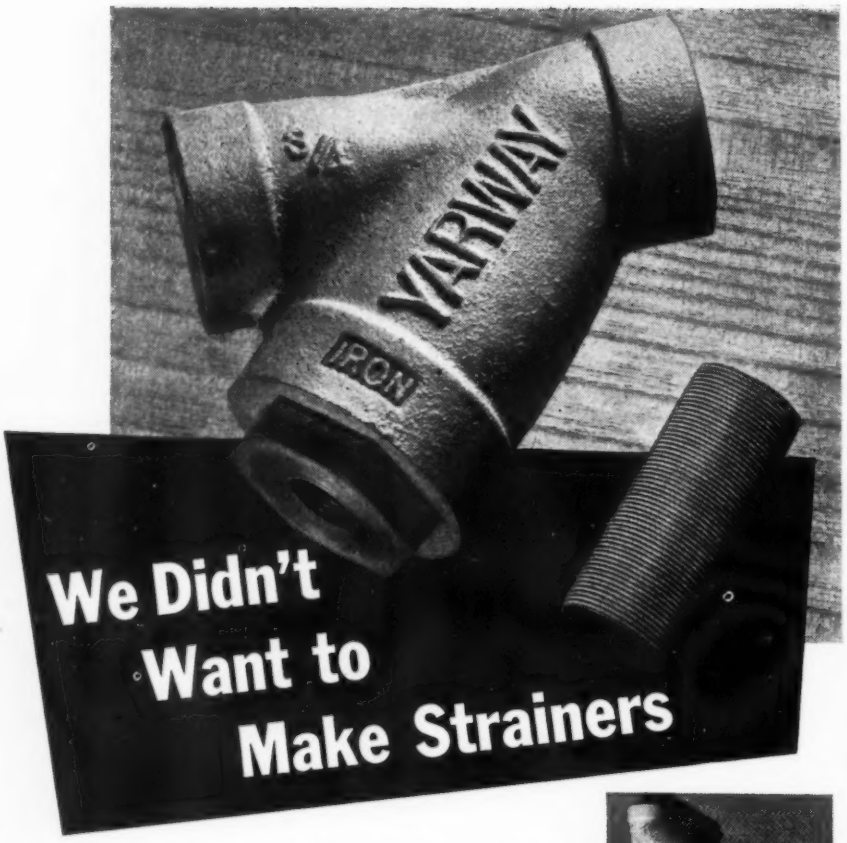

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BUT we needed them for use with Yarway Steam Equipment and couldn't find any to suit us.

So we designed the *YARWAY Strainer.*

Apparently a lot of other people were having "Strainer trouble" because, without a line of advertising, the Yarway Strainers *purchased* in a few years now number *many thousands.*

Why don't you look into this better Strainer for your money? Buy one from your supply house (over 100 Mill Supply Houses now have them).

See its protection against corrosion—*cadmium plating inside and out.*

Examine its *high grade Monel woven wire screen* that stops dirt—lets condensate or other fluids flow freely.

Notice the removeable blow-off bushing. Screen and bushing come out together—go back together, *automatically aligning.*

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YARWAY STRAINERS

a saving of about 29 million tons of coal.

Volunteer engineers and fuel utilization experts have visited scores of plants, and many have put into effect programs to save fuel and energy. Some plants report outstanding examples of fuel economy, lending hope that the campaign goal will be reached. Plant managers welcome the expert technical advice given without charge, as well as the opportunity to contribute to this vital war problem.

Names of the new area coordinators and their headquarters are: *Alabama:* Samuel S Williams, Birmingham; Gerald L Leff, Mobile. *Arizona:* S S Headman, Phoenix. *Delaware:* Robt P Schoenijahn, Wilmington. *Georgia:* A T Harrison, Brunswick. *Illinois:* Geo C Ensign, Elgin. *Indiana:* R W Noland, Fort Wayne; Adam L Bishop, Jasper; Dr P D Wilkinson, Terre Haute. *Iowa:* D A Davis, Mason City; Edw M Lewis, Sioux City. *Louisiana:* J M Guillory, New Orleans. *Michigan:* C C Dewitt, East Lansing. *Minnesota:* Elmer W Anderson, Austin. *New Hampshire:* Warren B Gifford, Laconia. *New Mexico:* E A Roberts, Carlsbad. *New York:* F Kenneth Rice, Jamestown; L O Angevine, Rochester; F W Aiken, Watertown. *Oklahoma:* Guy B Treat, Oklahoma City. *Pennsylvania:* Robt E Moyer, Jr, Allentown; Robt T Sternberg, Erie. *Rhode Island:* E F Walsh, Providence. *Tennessee:* J Marshall Johnson, Chattanooga. *Utah:* A J Forbess, Ogden. *Wisconsin:* Cal Clark, Wisconsin Rapids.

Help Prevent Heat and Power Waste, Says ASHVE

The war on fuel waste must go on, warned S H Downs, president, American Society of Heating and Ventilating Engineers. Government agencies have freely predicted that next winter's fuel supplies will be short: Coal production will be millions of tons behind demands, oil will not meet normal requirements for comfort, and gas supplies will be affected adversely.

Mr Downs pointed out that every means of fuel conservation must be applied in industry, homes, and every plant where fuel is used for heat and power. At its last meeting the society gave its wholehearted support to the National Fuel Efficiency Campaign, sponsored by U. S. Bureau of Mines cooperating with other government agencies.

It is vital that everyone prepare heating equipment for winter service so that every ton of coal will do 10% more, or the work of 2200 lb; that a 30-day oil supply will do 33-days heating; and that every 1000 cu ft of gas will do the work of 1100 cu ft. For effective fuel use, the Society makes eleven major suggestions:

(1) Recondition heating plant for winter service. (2) Maintain combustion efficiency. (3) Improve heat-distribution system. (4) Control temperatures and avoid overheating. (5) Do not heat unused spaces. (6) Insulate hot-water heater and piping. (7) Insulate walls and roofs. (8) Weatherstrip windows and doors. (9) Install storm windows and doors. (10) Fire available fuel properly (11) Keep windows closed.

Engine
No. 100,000
Already on its way to join the other Detroit Diesel 6-cylinder engines serving in America's landing craft, tanks, trucks, bulldozers and other war equipment.

10 DIVISIONS OF FIGHTING ENGINES

MONTHS ago the Detroit Diesel Engine Division of General Motors sent engine No. 100,000 off the production line to its war job. Many more have followed since. Measured as men, more than ten divisions of these six-cylinder Diesels are actively in the fight. They're in landing craft helping to crack Fortress Europe and to cut the Nips' string of islands. They're in tanks, trucks, bulldozers and all kinds of other equipment. The reasons are, these Diesels are tough and dependable. They're easy to maintain. They burn inexpensive fuel oil.

They have been tried and proved in all sorts of war jobs on every battle front. And they've been found good.

With the coming of peace these engines will be available for all the applications where America will need reliable, low-cost power.

KEEP AMERICA STRONG
BUY MORE WAR BONDS

GM
GENERAL MOTORS
DIESEL POWER

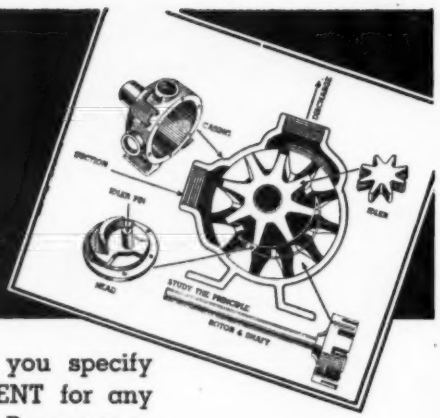
ENGINES . . 15 to 250 H. P. . . **DETROIT DIESEL ENGINE DIVISION,** Detroit 23, Mich.

ENGINES . . 150 to 2000 H. P. . . CLEVELAND DIESEL ENGINE DIVISION, Cleveland 11, Ohio

LOCOMOTIVES . . . . . ELECTRO-MOTIVE DIVISION, La Grange, Ill.

MEMO:

To Engineers and Purchasing Agents



You hit the jackpot when you specify Vikings as MUST EQUIPMENT for any rotary pumping job. Viking Pumps operate on the famous "gear within a gear" principle, with only four major parts and ONLY TWO MOVING PARTS. Simplicity of design, plus highest quality construction, carried forward for 33 years, have brought Viking to today's position of leadership in the rotary pump industry.

Write today for Bulletin 800 which gives complete information about Viking Pumps widely used in the power equipment field. IT'S FREE.

VIKING Pump COMPANY
CEDAR FALLS IOWA

An Interpretation of the New . . .

SAFETY VALVE STANDARDS

If you use safety valves, or design equipment using safety valves, this new Lonergan bulletin will be very helpful. The new official standard specifications are compactly shown in tabular form. Lonergan designs corresponding to the official standards are described and illustrated. Miniature "blueprints" of each design are included.

To get a copy of this handy reference, write for Information Bulletin #501-A.

SINCE 1872

Lonergan

J. E. LONERGAN COMPANY, 2nd & RACE STS., PHILA. 6, PA.

SAFETY VALVES · RELIEF VALVES · PRESSURE GAUGES · SPECIALTIES

ASME Nominates Alex Bailey for President

Alex D Bailey, vice-president of Commonwealth Edison (Chicago) and well-known power engineer, was nominated by the National Nominating Committee at the June Pittsburgh meeting of ASME for the office of president, for the year 1944-45. Vice-presidents, nominated for 2-year terms, were David Larkin, St. Louis, Mo., John E Lovely, Springfield, Vt., and Thomas S McEwan, Chicago, Ill.

The following managers were nominated for 3-year terms: Daniel S Ellis, Lima, O.; Arthur J Kerr, Tulsa, Okla.; Herman G Thielscher, Washington, D. C.

Election of officers will be by letter-ballot of the membership, closing Sept. 26.

Mr. Bailey went with Commonwealth Edison in 1903 and progressed through the

positions of chief engineer of the Fisk and Quarry Stations, superintendent of generating stations, chief operating engineer, assistant to vice-president, to (since July, 1944) vice-president. He has made many technical contributions in the field of large steam plants.

Diesel manufacturers of the San Francisco Bay area brought out the importance of their position in the industry at a recent luncheon, sponsored by the Diesel Engine Mfrs Assn. They have produced upwards of half a million horsepower to the value of $50,000,000, with the production rate mounting and the postwar picture bright.

Chas G Cox, vice-president, Enterprise Engine & Foundry Co, San Francisco, summarized the situation in his section thus: There has been a 10-fold increase in horsepower output since the war began, many more engines now being produced. Moreover, the industry faces no reconversion problem since its war product has no material changes. Because of its favorable geographical position, an excellent opportunity awaits the area to supply diesels to foreign countries, which will sorely need them in rehabilitation work.

G F Twist, vice-president of Atlas Imperial Diesel Engine Co, Oakland, stated that before the war his company's engines were in every country. Naturally, its war contribution has changed Atlas' distribution picture, but it will be heard from in postwar markets.

Fairbanks, Morse & Co's history, from the time of its first scale to the present when it plans to produce mainline loco-

Philadelphia

GEARED SPEED REDUCERS

ONE NAME — ALL TYPES

WORM GEAR SPEED REDUCERS

Our standard type Worm Gear Speed Reducers are made in both horizontal and vertical types . . . in a wide range of ratios and horsepowers. Catalog No. 25 gives construction details, dimensions, typical installations, etc.

HERRINGBONE SPEED REDUCERS

are available in single, double and triple reduction types. Standard ratios range from 1.75 to 1 up to 300 to 1. Efficiencies up to 98%. These units are also suited for speed increasing. Catalog H-39 contains full information.

SPIRAL-BEVEL SPEED REDUCERS

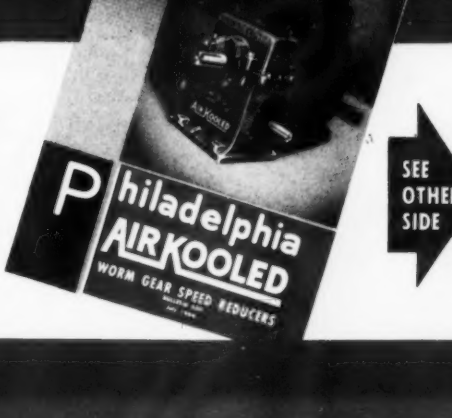
for right angle drives where high efficiency and smooth operation are desired. Efficiencies same as our Herringbone Speed Reducers. Available in single, double and triple reduction types in standard ratios from 1 to 1 up to 238 to 1. Full information in our Bulletin 200.

PLANETARY SPEED REDUCERS

are straight line type of reduction units, employing the same planetary principle of reduction that proved so successful in our MotoReduceRs. Single, compound and double reduction types, with ratios from 4 to 1 to 106 to 1. Sizes up to 100 horsepower. For full information get our Bulletin 100.

AIRKOOLED WORM GEAR SPEED REDUCERS

. . . offer considerably greater horsepower ratings than standard heavy duty type units for worm speeds of 580 to 1750 RPM. Suction fan on worm shaft draws cool air through double walled ribbed housing. Unit being more compact saves weight and space. Our bulletin 250 gives all the facts.



SEE OTHER SIDE

Philadelphia

POWER SAVING PRODUCTS

PHILADELPHIA MOTOREDUCER

. . . self-contained . . . motor and planetary type speed reducer in single, compact housing. Horizontal and vertical types. Numerous distinctive design features. Wide range of ratios and horsepowers. Complete description in catalog M. R. 40.

PHILADELPHIA GEARS

are made in all types and sizes for industrial service. In our shop we have the most modern equipment for producing gears accurately. Our gear catalog is a guide for all gear buyers and users.

PHILADELPHIA COUPLINGS

can be supplied in a number of different types to meet various requirements. Illustrations, descriptions and dimensions are included in our new Coupling catalog.

LIMITORQUE VALVE CONTROLS

are efficient, mechanically actuated devices for operating valves on steam, air, gas, water and oil lines. Operates by push button . . . saves time, trouble. Doors, damper controls, sluice gates, etc. offer further applications—Can be fitted to present equipment. Limitorque Control catalog shows the several types.

SEE OTHER SIDE

Gentlemen:

Please send me the following Philadelphia Catalogs:

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Mr. .....

Firm ..... Title .....

Address .....

A B C D E F G H I

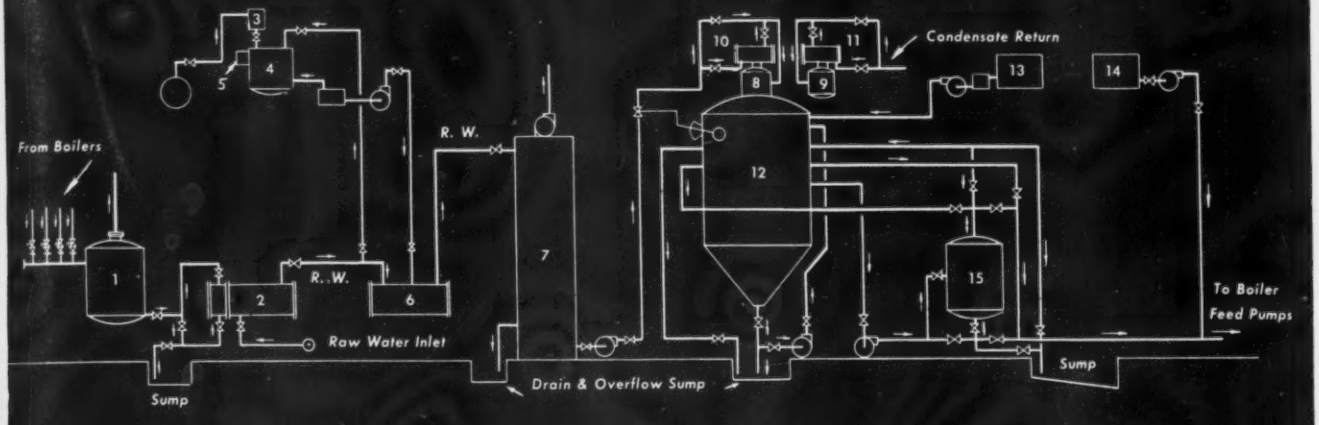
Industrial Gears and Speed Reducers
LimiTorque Valve Controls

Philadelphia

GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK · PITTSBURGH · CHICAGO

BOILER FEED WATER PROBLEM...



ANALYSIS and SOLUTION

THE ABOVE diagram shows the solution to an actual water conditioning problem for boiler feed water experienced by a leading industry. With the raw water available high in sodium bicarbonate as well as other impurities, acid treatment, degasification, hot process softening, deaerating and filtering provided an ideal feed water . . . eliminating losses due to corrosion, scaling and pitting, as well as furnishing freedom from excessive labor costs.

This is a typical example of Graver's approach to all such problems . . . analyzing, designing the entire conditioning plant, building the equipment and installing it in place. It is highly interesting to note that, aside from pumps, valves and piping, of 15 major units necessary to do the job, 14 are manufactured by Graver as part of their regular line of water conditioning equipment.

This undivided responsibility means real service, as well as dollars and cents saved, to you. You, or your consulting engineer, can receive all these benefits and more . . . cooperation on design and complete estimates without obligation. Whatever *your* water conditioning problem may be, boiler feed, process, or other—let Graver engineers work with you.

The *italic* items in the following list of equipment, corresponding to the numbered diagram, are manufactured by Graver.

1. *Blowdown Flash Tank*
2. Blowdown Heat Exchanger
3. *Strong Acid Tank*
4. *Dilute Acid Tank*
5. *Acid Proportioner*
6. *Acid Mixer*
7. *Degasifier*
8. *Raw Water Heater*
9. *Condensate Heater*
10. *Vent Condenser*
11. *Vent Condenser*
12. *Hot Process Water Softener*
13. *Chemical Agitator and Feeder*
14. *Phosphate Feed Tank*
15. *Filter*

GRAVER
WATER CONDITIONING EQUIPMENT

Process Equipment Division
of
GRAVER TANK & MFG. CO., INC.
4809-25 Tod Ave., East Chicago, Indiana
NEW YORK CATASAUQUA, PA. CHICAGO TULSA

THAT GIVES FIRE A FAST KO!

If there ever was a time when America could not afford to risk destructive fires around power production equipment, that time is NOW.

That's why you see PLUS-FIFTY DUGAS Dry Chemical on duty in so many vital spots today.

PLUS-FIFTY DUGAS DRY CHEMICAL STOPS FIRES FASTER!

Immediately on hitting fire (whether electrical or flammable gases or liquids) PLUS-FIFTY DUGAS Dry Chemical releases fire-killing gases —smothers fire speedily. Safe to use because of its long-range effectiveness and because it is non-toxic.

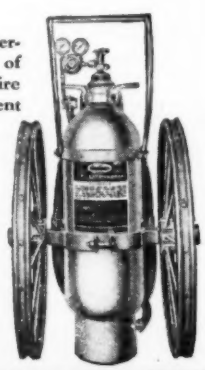
PLUS-FIFTY DUGAS Dry Chemical is harmless to everything except fire!

For priority facts regarding PLUS-FIFTY DUGAS Dry Chemical and DUGAS Fire Extinguishing Equipment, write us today.

Approved by Underwriters' Laboratories and Factory Mutual Laboratories.

PLUS-FIFTY
duGas
REG. U. S. PAT. OFF.
DRY CHEMICAL
U.S. PATENT 1793420

CHART showing characteristics of all types of approved hand fire extinguishers sent free on request.



MODEL 150 WHEELED EXTINGUISHER

DUGAS ENGINEERING CORPORATION, MARINETTE, WISCONSIN
OWNED AND OPERATED BY ANSUL CHEMICAL COMPANY

motives, was related by R M McMurray. Horsepower range of its engines, which include both marine and stationary models, is from 10 to 2000.

Speaking for a newcomer in the industry, W P Woolridge, assistant general manager of sales for Joshua Hendy Iron Works, said that the company has a long history in the power-unit field but only recently acquired its first contract for diesels, after having operated an experimental engine for a year.

16th National Power Show

This year's power show will be held in Madison Square Garden, New York City, Nov 27 to Dec 2. It will be keyed to the effective solution of continuing war production problems, particularly those caused by sudden shifts in military needs, demanded by the ever-changing scenes in Europe and Western Oceania. It will also provide informational sources for the advancement of postwar planning.

Held biennially, the National Power Show, as it is commonly known, is widely recognized as an effective institution to increase the use of the nation's power resources. The last exposition, held in 1942 in the midst of war work, proved exceedingly helpful to a wide range of new visitors, greatly expanding the service to industries in all fields. This year's show is expected to attract an even larger number of engineers, executives and operating personnel concerned with current production problems, as well as preparations for civilian pursuits.

More space has been provided than at the last exposition, number of booths has been increased, and advance bookings to the middle of July insure a greater number of individual displays than in 1942. Before fall, there will probably be a waiting list.

The show is under the sponsorship of an advisory committee, of which I E Moultrop, consulting engineer, continues as chairman. John H Lawrence is vice-chairman. Other members of the committee are: Comfort A Adams, Homer Addams, J T Barron, R E Dillon, S H Downs, A C Fieldner, N E Funk, David Moffat Myers, Joseph Pope, Arthur L Rice, A Bowman Snavely, A B Stickney, Philip W Swain, Alfred Vaksdal, Horace W Wilds. Charles F Roth is manager of the exposition. E K Stevens, associate manager.

As heretofore, the exposition will be open by invitation and registration to visitors directly associated with power and production operations, but closed to the public. No fee will be charged.

Myers, Fuller and Addington will continue the practice of Orrok & Myers, consulting engineers, with expanded facilities. Chas A Fuller is a specialist in heating, ventilating and air conditioning; Herbert B Addington, a power plant designer.

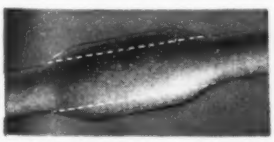
The firm is associated on active work and shares joint offices with Binger & Hammond, engineers (Walter D Binger and Lester C Hammond). They specialize in design of industrial buildings and structures of all types.

GROVE *Flexflo* REMOTE OPERATING VALVES *Control* EROSIVE CORROSIVE INFLAMMABLE LIQUIDS & GASES

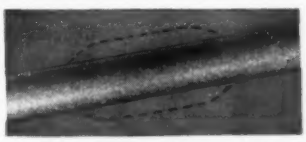
As the Grove Flexflo Remote Control Valve employs just one *(non-metallic)* moving part, it is especially suited for handling erosive, corrosive and inflammable fluids and gases. Its flexible synthetic tube expands to open and contracts to close by remote control. Therefore there is never the slightest possibility of damage, hang-up or injury resulting from the transmission of fluids containing sand, scale, cuttings or other fine solid particles. Abrasive wear is automatically compensated for, by the contractile elasticity of the flexive sleeve. Lithgow coating of inner surfaces of valve permits the handling of highly corrosive liquids and gases. Line fluid is completely sealed off from operating medium thereby eliminating the troublesome and dangerous hazards of stuffing boxes and exposed members. Clean sources of external operating fluid remove all problems of remote operation. Write for complete details today—ask for Bulletin 800.

- *Especially suited for frequent cycle operations*
- *Provides positive timing control of opening and closing*
- *Extremely resistant to corrosion and erosion*
- *Automatically self compensating for wear*
- *Insures positive bubble-tight, leak-proof shutoff*
- *Smooth non-turbulent streamline flow*
- *Avoids surges and line shocks*
- *Impossible to hang-up, stick or freeze*
- *Eliminates overhead chains, extensions and costly motorized equipment*

THE ORIGINAL EXPANSIBLE TUBE TYPE VALVE

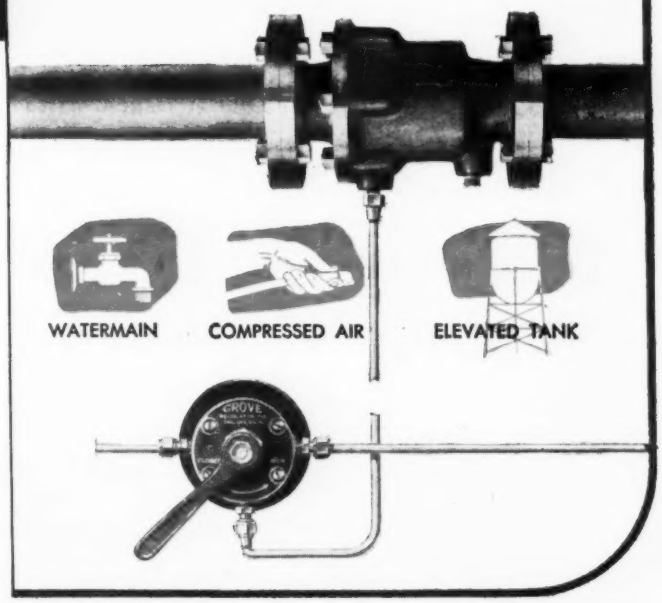


EXPANDS TO OPEN



CONTRACTS TO CLOSE

...BY MEANS OF ANY *EXTERNAL* SOURCE OF FLUID PRESSURE SUPPLY



GROVE *Flexflo* REMOTE CONTROL VALVES

GROVE SIMPLICITY ACCURACY SAFETY

GROVE REGULATOR COMPANY

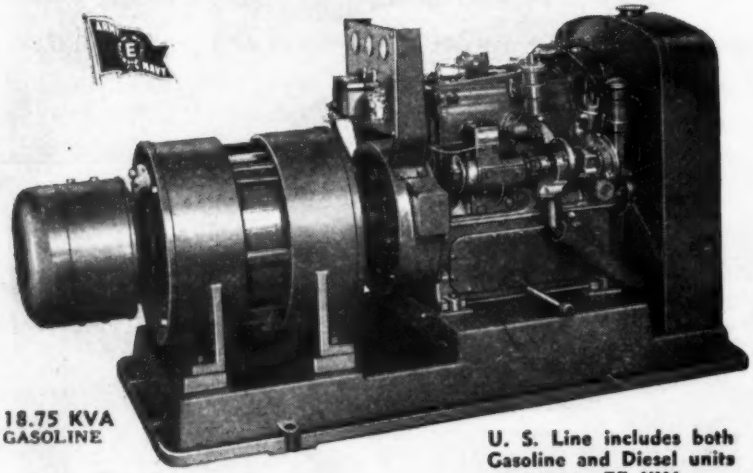
6547 GREEN STREET, OAKLAND 8, CALIFORNIA. *Branch Offices:* 30 Rockefeller Plaza, New York 20 • 5644 Navigation Boulevard, Houston 11, Texas • 1930 West Olympic Boulevard, Los Angeles 6, California

WRITE TODAY FOR BULLETIN 800

SUPPOSE
YOUR SOURCE OF
ELECTRICITY
FAILED
THIS MINUTE
?

Would an automatic emergency unit take over? Or would you just suffer your losses? The safest and best insurance against any such losses is a U. S. Stand-By unit. One failure might easily pay for the entire installation. Available now on AA3 priority or better. Write.

UNITED STATES MOTORS CORP.
552 NEBRASKA STREET • OSHKOSH, WIS.



18.75 KVA
GASOLINE

U. S. Line includes both Gasoline and Diesel units up to 75 KW.

U.S. Electric Plants
FOR STAND-BY SERVICE

National District Heating Assn Meeting

Following are highlights of the NDHA's 35th meeting in Pittsburgh, June 14 and 15.

Commercial Relations Committee: Geo H Tuttle, Detroit, reported that recommendations on conservation had been transmitted to utilities, and resulting advertising indicated their cooperation. Fuel has been saved but it is impossible to determine the amount.

Walter A Schulmeister, North Tonawanda, N. Y., presented charts for sizing economizers and condensate coolers, based on 100 Btu transfer, per hr per sq ft of surface, per deg mean temperature difference of the liquids. For clean ¾-in. tubes, low-friction loss and no baffling transfer usually lies between 85 and 100 Btu.

A F Metzger, Pittsburgh, presented a table showing estimated monthly steam use for water heating in office buildings, department stores, hotels, resident clubs, apartment houses, parking garages and theaters in pounds per cubic feet of space per 100-F increase in water temperature per year, with or without economizers. Knowing water temperatures and steam use in summer, one can estimate from this table the steam required to heat water each month in buildings where there is only a totalizing steam meter.

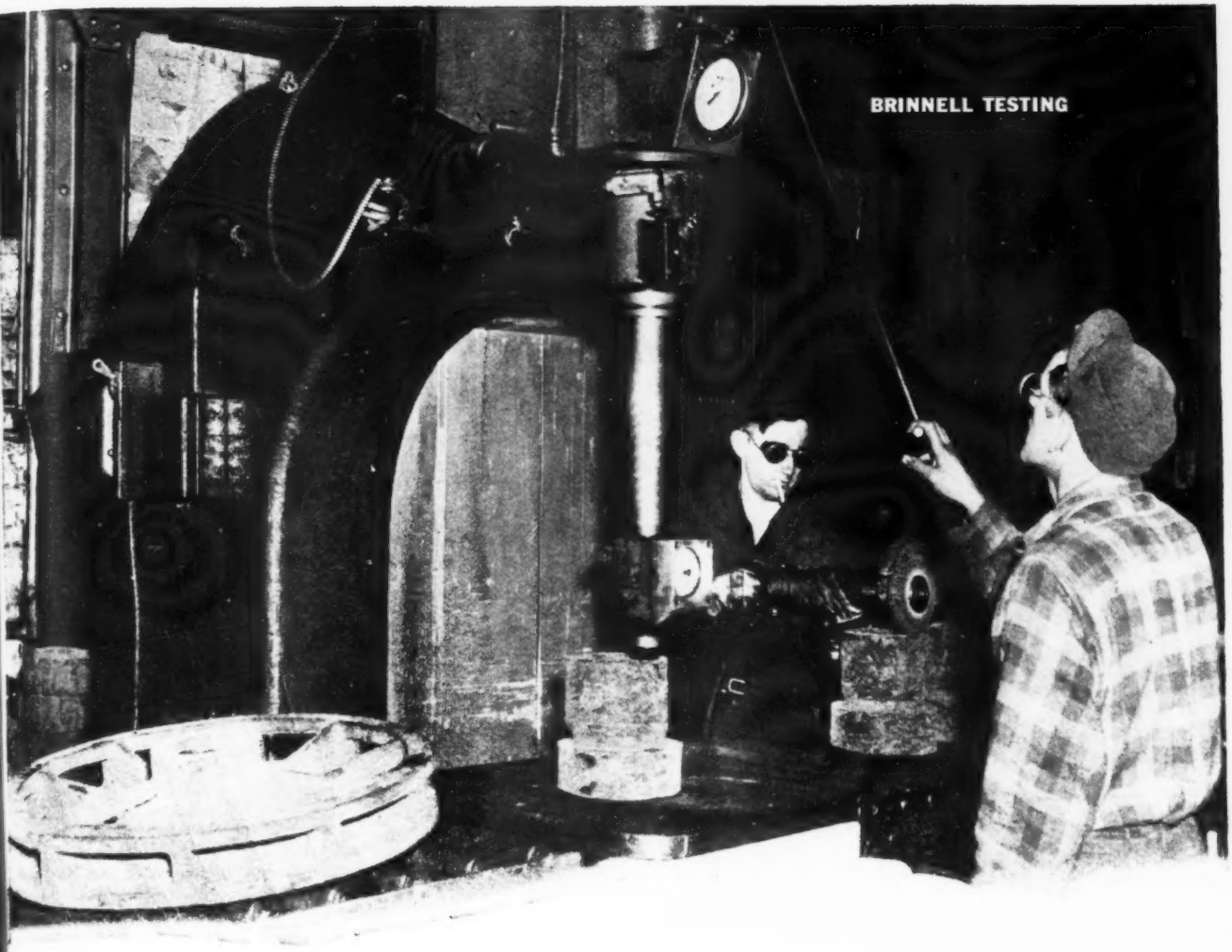
Research Committee: A R Mumford, New York, reported they had found that the "exposed area" basis of comparing steam use in buildings is much more accurate than the present "volume" basis. He said four companies were selling steam for summer air conditioning.

Secretary Collins reported that the natl joint comm on weather statistics, of which he is chairman, had agreed on: (1) Use of daily mean temperatures rather than daily average temperatures for degree-day computation. (2) Use of maximum-minimum thermometers rather than thermographs. (3) Retention of the present 65-F base for normal occupancy. (4) Use of the 20-yr average (adjusted) for computing normal degree-days for each day.

Chemistry Committee: Leo F Collins, Detroit, reported that corrosion troubles in heating systems are often the result of carbon-dioxide action. Proper venting can be devised where large amounts are present. Where small amounts are responsible for corrosion, ultimately boiler-water treating methods will eliminate CO_2, or chemicals produced to neutralize it.

Guest speaker A A Berk, associate chemist, U. S. Bureau of Mines, in concurring with Chairman Leo Collins, said additional tests will be run to determine which mines should be used for the most economical treatment.

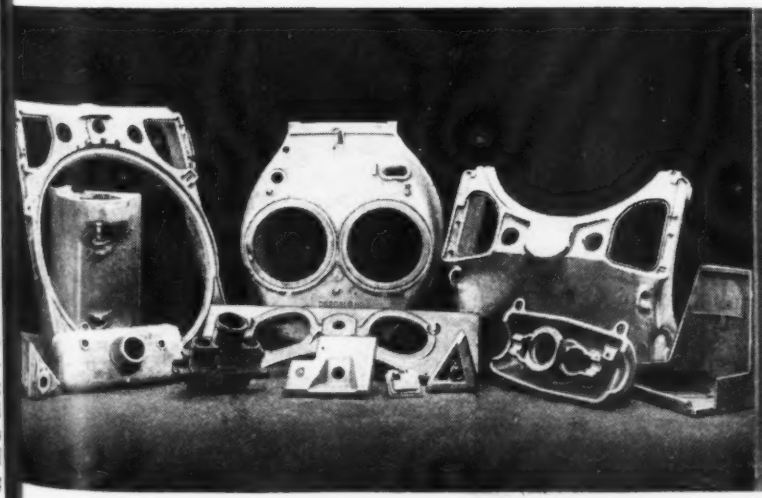
Technical Training Rehabilitation Committee, of the Cleveland chapter, National Industrial Advertisers Assn, is seeking advertising agencies' cooperation in an educational campaign for placing in the hands of wounded soldiers and sailors technical and business information to bring them abreast of current engineering and commercial developments. The plan calls for distribution of thousands of copies of technical, business and trade papers among



QUALITY STEEL CASTINGS

CONTINENTAL quality carbon and alloy steel castings are produced under high standards of craftsmanship and must meet complete inspection requirements before leaving the factory.

Continental's vast production capacity with modern equipment, special machinery, complete heat treating facilities and special inspection devices are the answer to Continental leadership in the steel casting industry. *Continental Foundry & Machine Company, Chicago—Pittsburgh.*

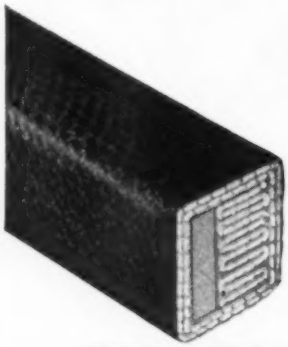


CONTINENTAL FOUNDRY & MACHINE COMPANY

CHICAGO - PITTSBURGH

FORMERLY
CONTINENTAL ROLL & STEEL FOUNDRY COMPANY

BELMONT PACKINGS



FOR RECIPROCATING STEAM RODS

Belmont 30

For reciprocating steam rods where boiler temperature is in excess of 100 lbs. (340 degrees F.)

FOR ROTATING SHAFTS

Belmont 754 P

For all types of centrifugal and rotary conditions, as well as oscillating rods.

FOR STEAM

Today, the war demands uninterrupted service of power plant equipment. Engines and pumps must be kept operating at maximum capacity—there is no time for frequent packing replacements.

Leaking valves . . . pistons . . . rods and plungers cause power losses which cut serious inroads into production.

Check now the packing in your stuffing boxes—at points of service—at prime movers—put the right packing on each job to avoid unnecessary delays through equipment failures.

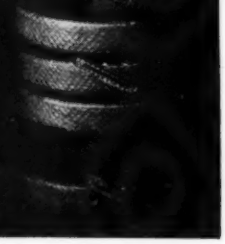
Above we illustrate two standard Belmont Packings for steam services. Belmont High Pressure Packing No. 30 is indicated wherever a packing is needed for high pressure steam rods, expansion joints, air and gas services.

For centrifugal and rotary shafts working against steam, water, oil and weak acids Belmont 754 P can be considered a standard packing.

Belmont distributors are located in every large industrial center, or write on your company letterhead for a copy of the Belmont Packings Catalog and see the complete Belmont Line in detail.

THERE'S A BELMONT PACKING FOR EVERY SERVICE

Steam, Water, Oil, Gas, Air, Acids, Alkalies, Ammonia. Forms include: Rings, Spirals, Coils, Reels, Spools, Sheets, Gaskets.



THE BELMONT PACKING & RUBBER COMPANY

BUTLER & SEPVIVA STREETS • PHILADELPHIA 37, PA.

hospitals and rehabilitation centers housing convalescent veterans.

Distribution of these copies, now buried in agency files and rarely referred to, will make available to a wider audience, at no extra cost in paper, the valuable information in business publications.

For further information address the committee chairman: John G. Stephan, Stephan National Industrial Adv Agency, Leader Bldg, Cleveland, Ohio.

AIEE president for the year beginning August, 1944 is Charles A Powel, manager of headquarters engineering, Westinghouse Electric & Mfg Co.

The president's badge was presented to Mr Powel at ceremonies opening the Institute's summer technical meeting. A

former vice-president and director of AIEE and long noted as a diagnostician of power-plant problems, Mr Powel told AIEE members that "one of the major tasks facing the institute during the coming year will be to aid in the education and eventual re-employment of the men released from the armed forces."

CURRENT AWARDS

Fourth star on Army-Navy 'E' burgee was awarded to the Cleveland diesel engine div of General Motors Corp.

Third star has been added to the "E" pennants of Independent Pneumatic Tool Co, DeLaval Steam Turbine Co, H M Harper Co, Builders Iron Foundry and the Philco Corp.

A two-star Army-Navy "E" pennant and **a two-star Maritime "M"** burgee fly over the Tube Turns, Inc, plant.

"E" pennants with two stars have been earned by the employes of Whiting Corp, Sarco Co, Inc, and The Foxboro Co.

A white star for their "E" flag was awarded to the Cochrane Corp.

Army-Navy "E" pennants were awarded to Goodyear Decatur mills and The York heat plants of York-Shipley, Inc.

Third additional gold star to their Maritime "M" Pennant has been awarded to Homestead Valve Mfg Co.

Maritime "M" awards have been made to Reliance Gauge Column Co, Kieley and Mueller, Inc.

National Security Awards (OCD) were given to The Appalachian Electric Power Co and Commonwealth Edison Co.

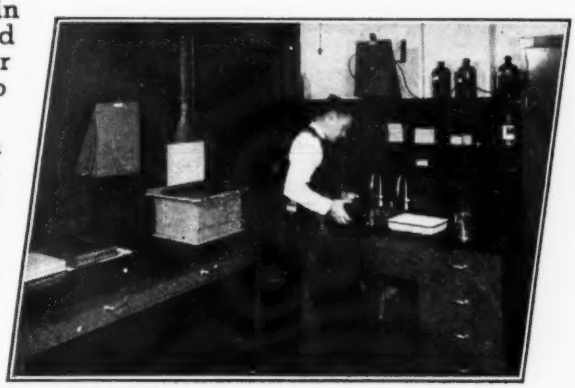
WARTIME PRODUCTION ..PEACETIME QUALITY

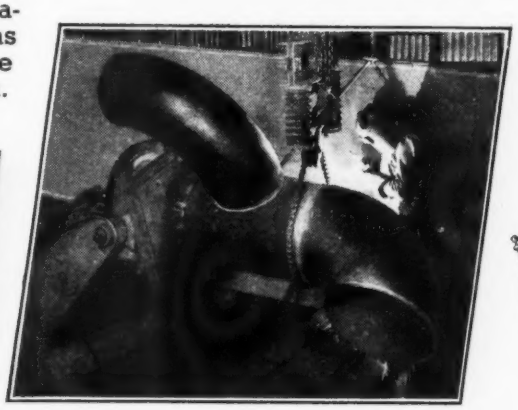
A long established system of laboratory control of both products and processes at Pittsburgh Piping & Equipment Company is of even greater importance in today's tremendously increased demand for war materials than in any era of peace.

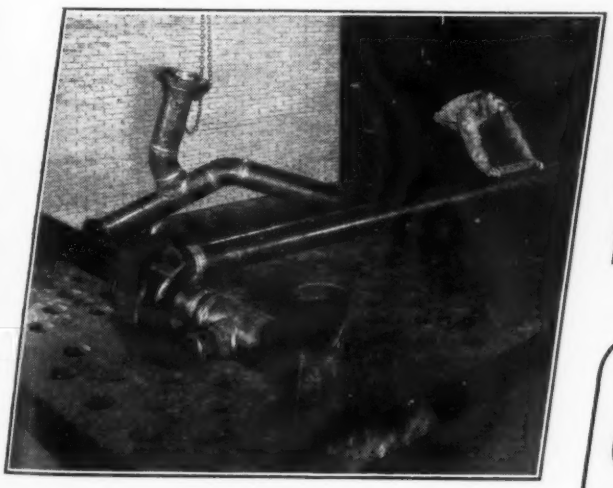
Such items as correct analyses, grain sizes and proper methods of testing and inspection are constantly checked by our metallurgical engineers in order to keep them up to our proven standards.

For more than forty years Pittsburgh Piping & Equipment Company has been engaged in developing time saving methods in fabricating and erecting power and process piping. Systematized pre-fabrication of large assemblies under controlled shop conditions results in faster construction schedules, with more accurate workmanship than is possible in the field.

You may enjoy the benefits of this extensive experience when planning alterations, improvements, or complete systems by contacting our nearest representative or writing us direct. There is no obligation.







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By
AUSTIN H. CHURCH,
M.E., Sc.M.,
Associate Professor of Machine Design, New York University

Supplying basic design theory, construction and application in use today—this long-awaited book is a modern work in English on centrifugal compressors and blowers—written from the *American* viewpoint. It presents essential time-tested material and methods that explain standard practice—plus basic information needed to understand and apply new theories as they develop.

Check these 6 IMPORTANT FEATURES

- ✓ "Church" shows you how to completely design a pump and blower
- ✓ It explains in detail the method of determining the vane shape of Francis-type and mixed-flow impellers.
- ✓ It saves you time and innumerable calculations, by providing a *removable* large-sized chart for calculating the stresses in a rotating disk.
- ✓ It supplies—for constant use—other valuable charts, diagrams and tables.
- ✓ It further clarifies this subject through a full explanation of the principles of regulation and testing of blowers and pumps—aided by numerous factual photographs of equipment.
- ✓ It supplies helpful practical problems (with answers).

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APPOINTMENTS

Westinghouse Electric & Mfg Co announces the appointments of **J S Henderson** as coordinator of rural electrification for industry departments, and of **R T E Bowler** as superintendent of the Homewood plant, manufacturing and repair department. **Floyd T Hague** is now assistant to the vice-president of the steam division, Westinghouse, in Philadelphia; **Walter A Alden** and **Randle L Nourse** have joined the application engineering staffs at Los Angeles and San Francisco.

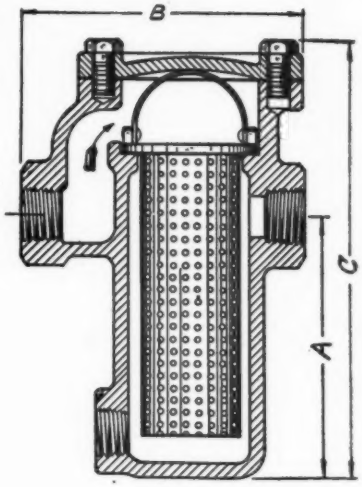
Frank W Shipley has been made foundry manager of the **Caterpillar Tractor Co,** and **L C Allenbrand,** manager of the merchandise department. **Howard R Murphy,** formerly manager of the merchandise department resigned to become associated as a principal with **W K Holt** in the Caterpillar distributorship in San Antonio and Corpus Christi, Texas.

General Electric Co's industrial control division has named **K R Van Tassel** manager. He succeeds **George R Prout,** who was recently appointed manager of the air conditioning and refrigeration division, appliance and merchandise department. GE also announces three appointments in the motor division: **Elliott Harrington** has been named manager of sales of a newly formed integral-horsepower, ac-motor section, and **J T Farrell,** manager of sales of an integral-horsepower dc-motor section, both in Schenectady; **D A Yates** is assistant manager of sales of both sections in charge of Lynn motor sales group, at the Lynn (Mass.) river works.

Thermoid Co appoints **A C Teetsel** manager of friction materials manufacturing . . . **Curtis A Haines,** of the Mill Hall and Altoona plants, **Sylvania Electric Products, Inc,** has been promoted to the position of general manufacturing manager of these plants and new ones at Huntington, W. Va. and Lexington, Ky. . . . **Allis-Chalmers** announces the appointment of **Howard C Herbert** as field engineer for steel mills in the Pittsburgh district . . . **H Dale Cook** has joined the controls division of **Perfex Corp** in a sales engineering capacity . . . **Talon, Inc,** steel tube division announces the following personnel changes: **Robert A Campbell** from sales manager to general manager (still directing sales activities) and **John Farrimond** to superintendent of finishing departments . . . **Kellogg Switchboard & Supply Co** announces the appointment of **F M Parsons** as sales manager and **C D Manning** as executive assistant to the president.

William Balderston, formerly vice-president in charge of the commercial division of **Philco Corp** has been elected vice-president, in charge of operations, and a member of the executive committee. The same company has appointed **William E Kress** sales manager of the Middle West . . . **Dudley Rice** was made a field engineer for the **Eutectic Welding Alloys Co** in the Chicago district . . . **William O Kellogg,** supervisor in the distribution department of **The United Illuminating Co**

EDCO STRAINERS



BASKET TYPE FOR VARIOUS FLUIDS

The EDCO basket type strainer is used extensively on suction and pressure pump lines carrying water, oil and other fluids.

The baskets are made from either brass or steel screens or perforated sheets, depending on the nature of the operation.

EDCO Strainers are easily removed for cleaning by the handle attached to the basket. The body and cap are cast bronze but can be made from steel or semi-steel, threaded or flanged.

EDCO makes strainers for steam — air — gas and fluids. Write today for detailed data on these products. They offer you many savings. Ask for Bulletin 863.

EDDINGTON METAL SPECIALTY CO.
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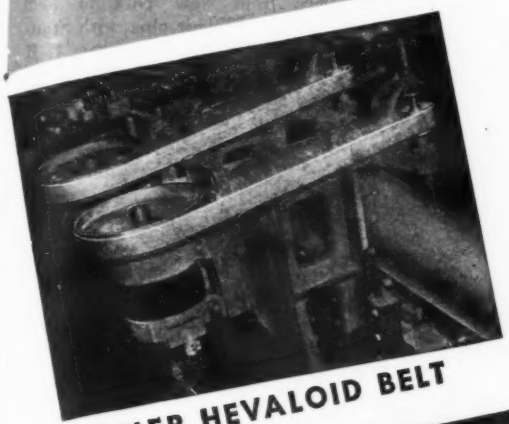

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GILMER SPEEDAGE BELT

GILMER *specializes* in belts! As the oldest firm of rubber-fabric belt specialists, with over a third of a century of experience in building belts for machinery all over the world . . . Gilmer has developed a complete line of standard V-Belts and Endless and Non-endless Flat Belts. The largest assortment of V-moulds in the world is maintained . . . necessary for the production of a well rounded line. In addition, engineering and manufacturing facilities are maintained for highly specialized belts for use wherever standard belts are unsuited.

V-Belts for multiple and light duty drives.

Kable Kord Flat Endless Cord Belts, a contactor and power belt, two-belts-in-one.

Gilmer Hevaloid Endless Belts: Light weight and vibrationless for high speed precision work.

Flat Roll Belting for line shaft drives.

High Speed Belts **Special Endless Belts**

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and Belts for Textile and other specialized industries.

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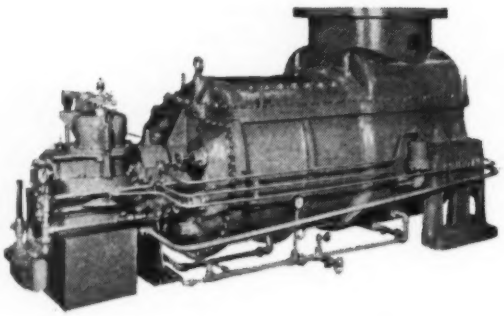
MURRAY

MULTISTAGE STEAM TURBINES



One of three 2000 HP Type UV Murray Multistage steam turbines furnished to drive high pressure centrifugal lean oil pumps in a Southwestern oil refinery. Turbine is direct connected to the pump operating at 3600 rpm. Operating steam conditions are 250 lbs. initial pressure, 500 degree Fahr. total temperature, exhausting condensing to 26 inches Hg. vacuum. A total of 14 Murray turbines are installed in this refinery.

Having 4 inch inlet flange, 30 inch. exhaust flange, mechanical governor with hand speed changer, flexible pedestal type center-line support, and force feed lubrication, the machine is representative of our full line of multistage steam turbines

Murray also Builds:

Turbine Generator Units to 2500 KW Rating

Reduction Gears

Mechanical drive turbines—horizontal or vertical.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

retired after 55 years service . . . **Sylvania Electric Products Co** has promoted **Frederic J Robinson** to the position of sales manager for Latin America.

William Hogan is now Hydroseal pump engineer for the **Allen-Sherman-Hoff Co** and will cover the Southeastern states; **J C Tyger,** also Hydroseal pump engineers, will cover the Midwestern states . . . **Robert Holmes & Bros, Inc,** has been appointed stocking distributors by **Manning, Maxwell & Moore,** for the following lines: Hancock bronze and steel valves, consolidated valves, Duragauges, Ashcroft gauges, American thermometers and American industrial instruments . . . **Dowell, Inc** announces the removal of its Eastern district office from New York to 1400 Girard Trust Bldg, Philadelphia, with **Stanley C Morian** as district manager, **L B Wilson,** development engineer and **M M DeWitt,** district engineer. The company will continue its New York office under the management of **W E Bisler;** Upper Montclair, N. J. and Wilmington, Del. treating stations will continue to be managed by **B H McDaniel** and **J S Grass.**

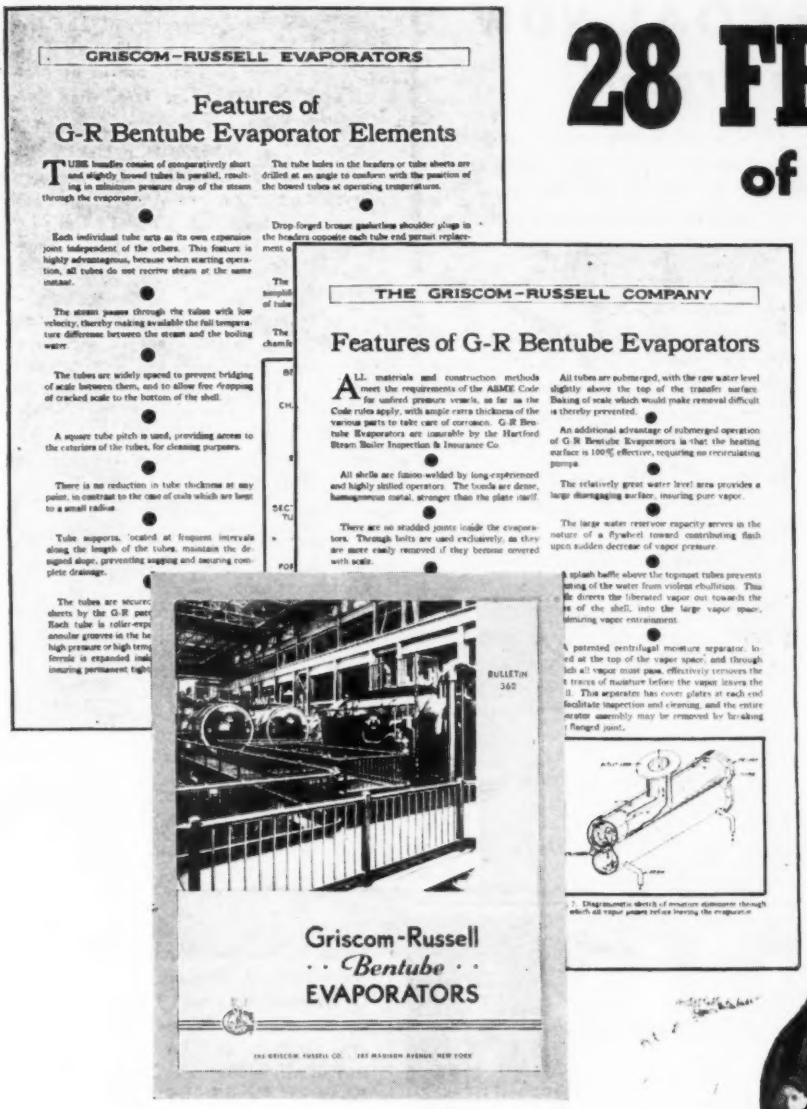
Houdaille-Hershey Corp bought all of the stock of the **Honan-Crane Corp,** the latter to operate as a subsidiary of the former company with no interruptions in manufacturing or sales activities or changes in executive leadership . . . **Wickwire Spencer Steel Co** announces the purchase of the business and assets of the **Sirian Wire and Contact Co** and the formation of a new subsidiary, the **Wickwire Spencer Metallurgical Corp.** Officers of the new metallurgical corp are: president, **E P Holder;** executive vice-president, **Lt Col Cecil P Young,** retired; treasurer, **George H Creveling;** secretary, **Franklin Berwin.**

Brace-Mueller-Huntley has been appointed sales representative for Timken electric furnace alloy steels, seamless alloy steel tubing and stainless steels, of **The Timkin Roller Bearing Co . . .** Chief administrative offices of the Pomona pump division of the **Joshua Hendy Iron Works** have been moved to Sunnyvale, Calif., for consolidation with the general administration of the company. Affected by this change are the sales, engineering, purchasing and accounting departments; among those moving their offices north are **Arnold Brown,** sales manager; **A W Moore,** advertising manager and **Ralph Linderman,** export manager: manufacturing activities will be continued in the Southern Calif. plants at Pomona and Torrance.

Busch-Sulzer Bros—Diesel Engine Co announces the retirement of their president, **Edward B Pollister,** who will be succeeded by **Norris H Schwenk . . .** The gas scrubber division of **Peabody Engineering Corp** made **David P Graham** assistant to the president . . . **Wallace C Husted** is vice-president in charge of all Cleveland operations of the **Chase Brass & Copper Co's** Waterbury Mfg Co division. **The Institute of Metals** announces the retirement of **G Shaw**

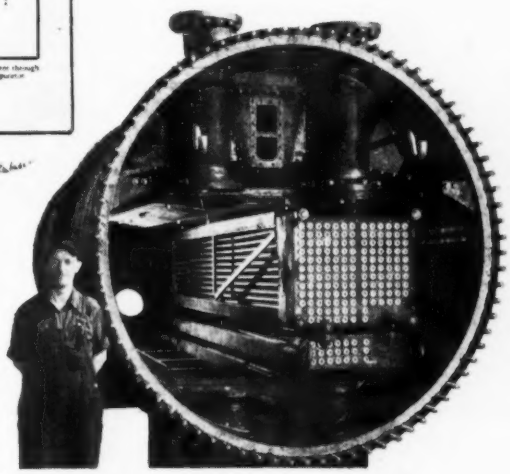
28 FEATURES of G-R BENTUBE EVAPORATORS

that every plant engineer should know about



IN addition to their famous thermal scale-shedding feature, G-R Bentube Evaporators have more than two dozen advantages which provide greatest production of vapor with greatest possible purity, and most convenient operation with least attendance and maintenance expense.

These features . . . of interest to every plant engineer . . . are fully described in Bulletin 362, which also illustrates the various types of G-R Bentube Evaporators for large, medium and small capacities, and explains in detail when evaporators should be used for boiler feed make-up. Write today for your copy of this informative bulletin.



This end view of G-R Type J Bentube Evaporator shows the low tube bundle, large vapor space, ample space at bottom for cracked scale, and accessible connections. Other important features are described in Bulletin 362.

The Griscom-Russell Co.
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GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

STORE MORE COAL NOW
The Need is Urgent!

Above is a 6 cu. yd. Sauerman Scraper reclaiming to receiving hopper at corner of a 180,000-ton storage pile. Coal moves from hopper by belt conveyor to power plant. Operating on a 300-ft radius, this scraper handles an average of 240 t.p.h., either storing or reclaiming.

HEADS of government and industry agree that increased storage of coal is needed now to safeguard manufacturing schedules in the months to come.

In answer to the need, Sauerman Power Scrapers are being installed at numerous plants throughout the nation, in some cases to provide coal storage where none existed before; in others, to expand existing storage facilities at low cost.

Sauerman Equipment stores and reclaims safely, rapidly, cleanly for only a few cents per ton. Builds a homogeneous pile in compact layers—free of combustion hazards. Operates with a minimum of champing across pile and avoids dirt and dust of heavier equipment.

Write for Catalog

SAUERMAN BROS., Inc.

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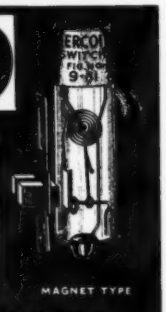
MERCOID

The Only 100% Mercury Switch Equipped Controls



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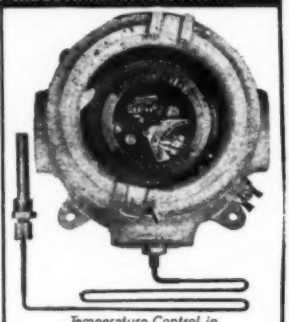
MAGNET TYPE

FOR HEATING, AIR CONDITIONING, REFRIGERATION, AND VARIOUS INDUSTRIAL APPLICATIONS

Pressure Control

Designed to automatically regulate electrically operated equipment in accordance with changes in temperature, pressure, vacuum, fluid level or mechanical movement.

Mercoid Controls have many desirable features which have made them favorites among leading industrial engineers.



Temperature Control in Explosion-proof case

DA (Double Adjustment) Temperature or Pressure Controls are used extensively on industrial applications. The outside double adjustment facilitates the control operating range setting. The calibrated dial plainly indicates the desired setting. All guesswork is eliminated. No cover to open or remove when making control adjustments. A locking device is provided to prevent tampering. Various ranges available.

The hermetically sealed mercury switches are dust and corrosion-proof. There is no open arcing, pitting or sticking of contacts. These switches assure better control performance and longer control life.

If you have a pressure or temperature control problem Mercoid engineers will assist you.

See catalog No. 600 for complete information on all types of Mercoid Controls.

THE MERCOID CORPORATION, 4225 BELMONT AVE., CHICAGO 41, ILLINOIS

Scott from the secretaryship. He will be succeeded by **K Headlam-Morley,** who will continue as secretary of **The Iron and Steel Institute . . .** The election of **J E Swanson** as a vice-president of **Graver Tank & Mfg Co, Inc,** has been announced.

William J Priestley has been elected president of Electro Metallurgical Co, Electro Metallurgical Co of Canada, Ltd, Michigan Northern Power Co and Union Carbide Co of Canada, Ltd, units of **Union Carbide and Carbon Corp. . . .** The appointment of **Carl J Dinie** as assistant to the president of the **American Locomotive Co** has been announced: **Perry T Egbert** is vice-president in charge of diesel locomotive sales; **William S Morris,** vice-president in charge of steam locomotive and divisional sales and **James D Vaughan,** comptroller.

Independent Pneumatic Tool Co has named **H Ritchotte** manager, contractor's tool division in Chicago. . . . **Jay W Owings** resigned as deputy chief of the pipe branch, steel division of the War Production Board to rejoin the **Youngstown Sheet and Tube Co** as assistant manager of tubular sales . . . **H O Teeple,** chemical engineer, joined the **International Nickel Co's** technical service group, development and research division . . . **David M Kelly** has been appointed to the engineering staff of the **John C Dolph Co,** in charge of the industrial service division.

United States Rubber Co names **Clarence L Wanamaker** general manager of the munitions division. He succeeds **Ernest G Brown,** who was recently chosen general manager of mechanical goods, general products and Lastex yarn and rubber thread divisions . . . **R H Olsen** of the **Electric Machinery Mfg Co** has been appointed vice-president in charge of sales, with headquarters at the home office in Minneapolis . . . **The Whitlock Mfg Co** made **Raymond B Prouty** vice-president in charge of sales and **Norman W Stirling** sales manager.

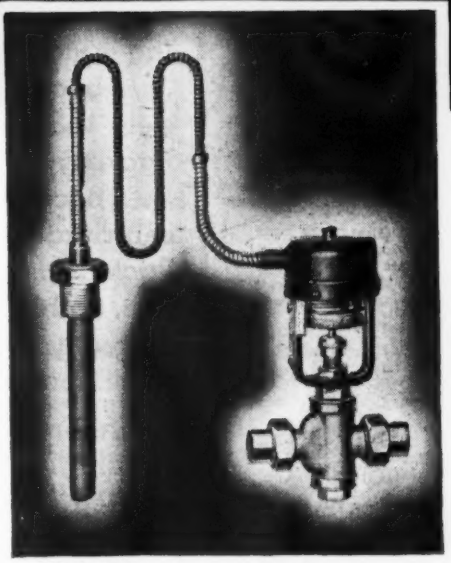
F T Turner has been promoted to the position of assistant sales manager of the **Osborn Mfg Co's** brush division . . . **Kieley & Mueller, Inc** appoints **Stanley L Burgess** their agent to cover the Detroit area . . . **F F Sampson,** manager of the New York branch **The Electric Storage Battery Co,** has retired: **Daniel P Orcutt** succeeds him . . . **Elgin Softener Corp** appoints **B M Thompson** district engineer in lower New York State and upper New Jersey, and **Orra F Hawn** district engineer in upper New York State.

Briggs Clarifier Co appoints the following zone managers and distributors: **Thomas W McKinley** in the Southeast, with headquarters in Atlanta, Ga; **Donn Murphy** in the Southwest, with headquarters in Dallas, Tex.; **A H Martin** in the West, with headquarters in San Francisco. The company's new distributor appoint-

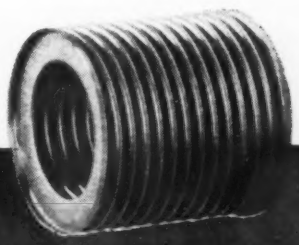
INDUSTRIAL PROCESSES—heating, ventilating and air-conditioning—wherever temperatures are involved, you'll find Sylphon Regulators serving like the balance wheel of a fine watch—guarding against variation.

These time-proven controls are ever alert to slight variations in temperature and respond promptly, adjusting the steam flow to maintain the temperature desired. Self-powered and self-reliant—their rugged simplicity assures long, trouble-free operation.

Whatever your control requirements—present or contemplated—our forty years' experience in the development and manufacture of controls and engineering their applications should prove quite valuable to you. May we assist with your control problems?



No. 921 Regulator—one of many types and sizes available for controlling temperature of air or gases. Write for bulletin No. RS-20.

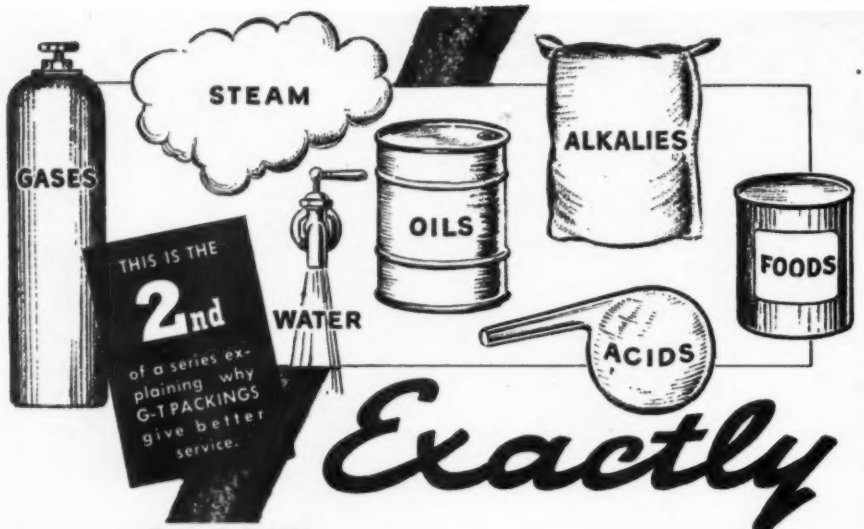


FULTON SYLPHON

TEMPERATURE CONTROLS BELLOWS BELLOWS ASSEMBLIES

THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

Canadian Representatives, Darling Brothers, Montreal



THIS IS THE 2nd of a series explaining why G-T PACKINGS give better service.

Exactly the RIGHT packing for each service

8 REASONS for the Superiority of G-T Packings

1. SIMPLE LINE . . . makes correct selection easy
2. COMPLETE LINE . . . an exactly suitable type for every service
3. SELF LUBRICATING . . . each individual strand saturated with lubricant
4. SPECIAL LUBRICANTS . . . lubricant for each service specially compounded in our own plant
5. SELECTED YARNS . . . provide tensile strength and resist high temperature
6. CONSTRUCTION . . . assures maximum endurance, longest life, lowest friction
7. EXPERIENCE . . . 80 years of manufacturing experience.
8. PERFORMANCE . . . proven in thousands of plants of every type

There are no compromises in G-T packing recommendations. In yarns . . . in construction . . . in lubricants . . . each G-T packing is specially prepared and perfectly adapted to the range of service for which it is offered.

For example, SUPER CUTNO Packing is made of African blue asbestos . . . because blue asbestos best resists the action of acids. PALCO Packing is made of plaited cotton . . . because that is best suited for centrifugal water pumps. KLERO Packing is lubricated with a stainless, edible lubricant . . . to make it perfectly suitable for white paper stock, food stuffs, etc.

Therefore, when you use a G-T Packing, you can be sure of longest service . . . fullest protection to rods, shafts and stems . . . least packing maintenance expense.

GREENE, TWEED & CO.
Bronx Blvd. at 238 St., New York 66, N. Y.
PLANTS: New York, N. Y. and North Wales, Pa.

PALMETTO for steam, hot water, air. PALCO for water. PELRO for oils. CUTNO for alkalis. SUPERCUTNO for acids. KLERO for foods, etc. PALMETTO SUPERSHEAT PACKINGS

G-T self-lubricating PACKINGS

ments include: **W P Childs Machinery Co** of Atlanta, Ga., for western Tennessee and north and central Georgia; **Pate Supply Co** of Birmingham for Alabama; and **Sullivan-Mears Co** of Kansas City, Mo. for Kansas and Missouri.

OBITUARIES

Harry D Mitchell, manager, PIV and gear reducer division, Link-Belt Co, died July 3, at the age of 54, after a severe illness. He had served the company in various capacities since 1906.

H Edward Manville, Sr, 72, former chairman, board of directors of Johns-Manville Corp, died June 27. Because of ill health he had retired from active business in 1939.

Daniel C Green, chairman of the board and chief executive officer of the Cleveland Pneumatic Tool Co and Cleveland Pneumatic Aerol, Inc, died July 2 after a seven weeks' illness.

James Edward O'Connor, 50, vice-president and secretary of the Pennsylvania Water & Power Co, died suddenly in Baltimore, July 19.

Edward H Lunken, 83, chairman of the board of The Lunkenheimer Co, died July 19 of a cerebral hemorrhage.

Color Code

(*Continued from page* 81)

If the colored application points become dull or worn off, the oilers repaint them. Keeping colors bright promotes good housekeeping and the operators also become lubrication conscious. Time spent by oilers touching up the lubrication-point colors is saved many times by the ease in finding oil cups. Search for hidden cups is eliminated by the colored spots or the arrows that always stand out as the proverbial sore thumb does.

With a lubrication color code, a mechanic who wishes to lubricate the bearings of a machine he has repaired and assembled, looks at their color and gets an oil of a matching color from the oil room. The machine therefore gets the grade recommended by the lubrication engineer.

When new equipment comes into the plant, it is not used until it has been properly color coded by the lubrication engineer and its bearings lubricated accordingly. On new machinery, the manufacturer's recommendations are followed for lubricant to use. Trade names are forgotten, but if there is any doubt about lubrication instructions, the engineer communicates with the equipment manufacturer and immediately settles any question about the correct lubrication.

ANYTHING THAT WILL . . .

BURNS BETTER WITH

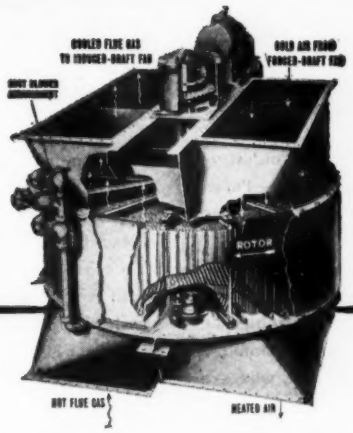
Preheat Engineering

• When availability, rather than quality, determines your choice of fuel, high-efficiency preheat helps keep your output high. In the present emergency, Ljungstrom-equipped plants have found it possible to use coals having considerably higher ash and moisture contents than that for which the plant was originally intended, and still hold to rated capacity. At oil refineries, a higher percentage of waste products has been successfully burned.

Any fuel will burn better with an adequate supply of high-temperature combustion air. On boiler plants, refinery furnaces, metallurgical furnaces, and many others, Ljungstrom Air Preheaters permit more complete heat recovery in a unit of practical size and weight. Operation is highly flexible to meet changing fuels or operating rates.

ENGINEERING SERVICE

The engineering staff of the Air Preheater Corporation is prepared to assist you in applying standard or special types of Ljungstrom Preheaters to your fuel conservation needs, or to help you and your engineers make better use of low-grade, more abundant fuels.



THE LJUNGSTROM AIR PREHEATER

The heating surface is contained in a compact, slowly rotating cylinder. Soaking up heat from the hot flue gases, it then rotates to a chamber where it liberates the heat into incoming combustion air.

This continuous, regenerative, counterflow principle assures maximum heat transfer with minimum weight and size. Generally, the Ljungstrom weighs less than half as much as tubular or plate preheaters of similar capacity. With the Ljungstrom, it is possible to obtain preheated air up to 1500 deg. F.

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Clamp – Splice – Tie –
Repair – Mend – Reinforce
with

PUNCH-LOK
Streamlined
BANDING METHOD

In all types of industry—production, maintenance or service—Punch-Lok Banding Method is at work . . . connecting hose, stopping leaks in steam or water lines, splicing electric cable, reinforcing and mending splits in cross-arms, poles and ladder rails, tieing rigid conduit or flexible cable to pipe lines or girders, seizing ends of wire or manila rope to prevent fraying . . . in short, wherever a banding method can be used to connect, mend, splice or reinforce. Open end bands available for use when ends of work are obstructed. There are places in your industry where Punch-Lok Clamps would save you time and money.

CLAMPS . . . Made of flat, high tensile galvanized steel or of Everdur, which is a corrosion resistant copper base alloy. All clamps are double wrapped. Available from ¾" to 48" I.D. Any larger size clamp can be pulled down to fit any smaller diameter.

LOKING TOOL . . . Sturdily constructed to assure long life. Locks all size clamps with a sufficient tensional pull.

GROOVED FITTINGS . . . For hose lines—air, water, steam or any other fluids. Permits application of high pressure clamping without damage to hose.

★ *Write for Descriptive Catalog and Name of Local Distributor*

PUNCH-LOK COMPANY

Dept. P 321 N. Justine St.
Chicago 7, Illinois

Pipe Flow

(*Continued from page 84*)

8. Using equation (10) calculate L for each value of p_x
9. Plot values of p_x against L
10. Calculate the acoustic velocity to determine if attained at the end of the pipe before receiver pressure is reached, in which case the fluid will emerge from the pipe at a pressure higher than receiver pressure.

This general procedure has been followed in the illustrative numerical example of Table II, worked out for actual published test data so that computed pressures and lengths of pipe can be compared with those determined by test.

The integration of the factor $dp \div v$ may be done graphically as in Fig. 3 by plotting values of $1 \div v$ against p. In this example, the relation is so near a straight line that numerical summation using average values is possible.

In the final summation, Table II, of $A - B$, it will be noted that the calculated length reaches a maximum at a value of p_x between 53 and 41.5 psi, beyond which point the value of L decreases. This indicates that the limit of free expansion and the acoustic velocity have been reached. Compression would be required to produce flow in a pipe of greater length. The true limit of backpressure is found to be 43 psi from plot of acoustic velocity, Fig. 4.

Fig. 2 shows the calculated pressure-loss length-of-conduit relation. Close agreement between calculated and test values is apparent except at the extreme end of the pipe where acoustic velocity has been reached. Here a difference of 6 psi is noted. The calculated length of 53 ft compares closely with the test length of 54.4 ft.

It should be observed that pressure in the end of the pipe does not reach receiver pressure of 12.8 psi, as is often assumed in error under the supposition that the whole pressure drop between source and sink, which the pipeline connects, is available for production of fluid flow.

The American Welding Society will hold its 25th annual meeting at the Hotel Cleveland, Cleveland, O., week of Oct 16, in conjunction with the National Metal Conference.

Special features will be the C A Adams Lecture by Dr A B Kinzel, Union Carbide and Carbon Corp, and talks on welding aids to the war effort, covering ship construction, fabrication of ordnance equipment, aircraft building.

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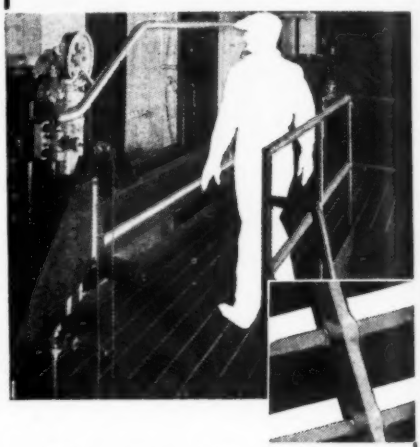

The patented fillet weld on the Hex cross bars of **BATES • GRATES** gives you a combination of maximum strength and floor safety . . . PLUS easier maintenance. That's why it's so much more worthwhile to specify **BATES • GRATES** for your open steel stair treads and flooring.

The new 16-page **BATES** *Book offers you new ideas for plant planning. It tells you what you want to know about open steel flooring. Write for your copy today.*

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OPEN STEEL FLOORING • STAIR TREADS

INDUSTRY'S TASK FORCE

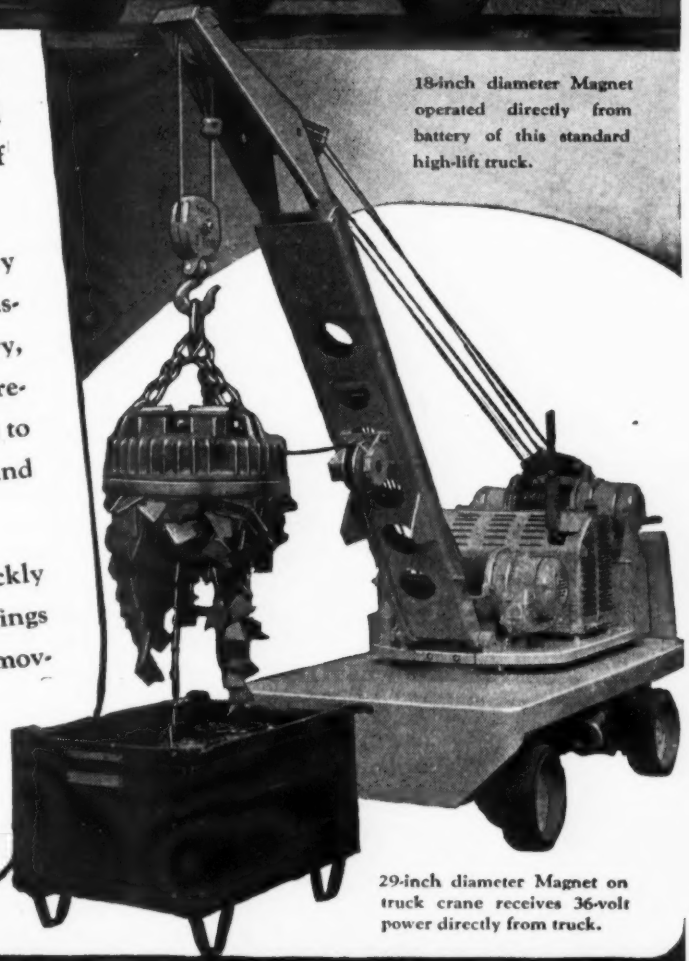
SMALL MAGNETS on Lift Trucks

MANY plants are now using this task force of EC&M small magnets mounted on industrial trucks for a clean sweep of production lanes.

These easily handled mobile units scurry around the plant through narrow passages, into the corners, around machinery, picking up bolts, nuts, turnings, and tire-injuring scrap. They "sweep" hazards to men and equipment from the floors and save valuable materials.

They also handle plant materials quickly and at little cost, such as lifting castings and forgings from floor to machine, moving products in and out of boxcars, and other similar lifting and moving jobs about the plant.

18-inch diameter Magnet operated directly from battery of this standard high-lift truck.



29-inch diameter Magnet on truck crane receives 36-volt power directly from truck.

EC&M Circular Magnets come in ten sizes for all industrial needs. Ask for Bulletin 900

THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79th STREET CLEVELAND 4, OHIO

BOILER ROOM FOREMEN MAKE SANTOSITE TESTS

TESTS to determine the sodium sulfite in Santosite-treated boiler water are easy to make. In plants where the services of a chemist are not available, boiler room foremen do the testing themselves.

At your request, we shall be pleased to send complete details on these tests.

Santosite (Sodium Sulphite Anhydrous, Technical) can be applied to boiler feed water through standard chemical solution feeders. Users, both large and small, find that maintaining 30 parts of Santosite per million parts of water *in the boiler* is *assurance* against oxygen corrosion within the boiler. Such protection means fewer shutdowns ... fewer repairs ... greater economy ... greater efficiency.

For further details, please get in touch with the nearest Monsanto office or write: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.
District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Seattle, Montreal, Toronto.

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

Gas Turbines

(*Continued from page* 94)

and needed internal wiring is included.

Governing and protective devices include a fuel-oil regulator, electric remote speed-regulating device, overspeed (10%) governor, temperature control and limit devices. Lubricating and governing oil system comprises a main oil pump, rotary gear type, motor-driven auxiliary oil pump for starting, oil tank and oil cooler requiring about 10 gpm of 68-F water.

Other auxiliaries are a motor-driven fuel-oil pump with oil filter and heater, cooling-water pump and oil-leakage pump, all motor driven. Not included are means for supplying power during starting, exterior piping, main generator switchboard and cables.

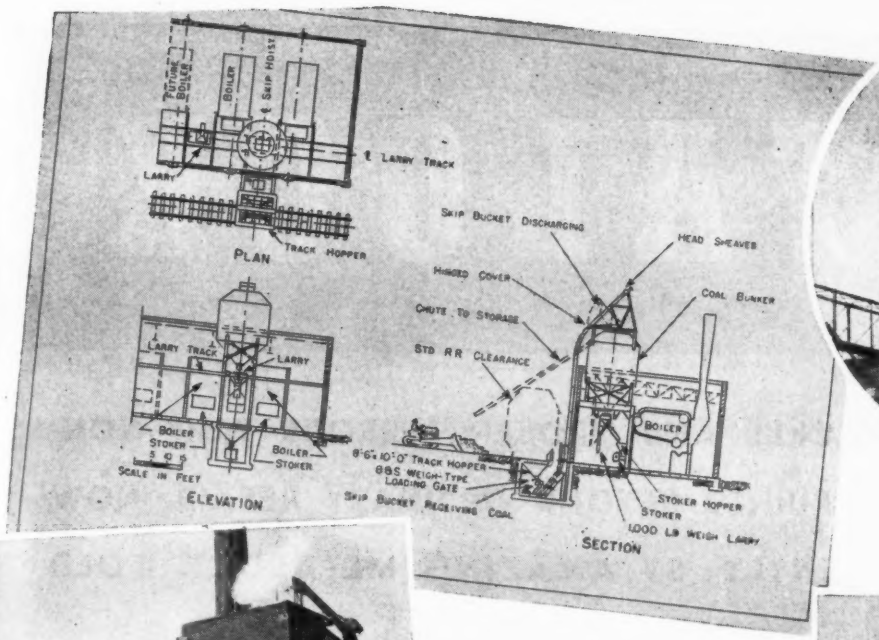
For a 5000-kw single-shaft machine, speed is 3000 rpm, suitable for a direct-coupled generator at 50 cycles or geared generator at 1800 rpm, 60 cycles. A 37,500-sq-ft counter-flow tubular heat exchanger occupies a 15x15x11 ft space while the larger 65,000-sq-ft recuperator needs 20x15x12 ft.

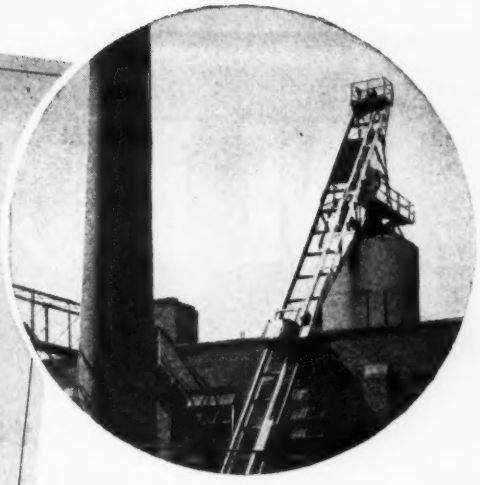
Generator air cooler for this machine passes 18,300 cfm and needs 135 gpm of 68-F water. Oil cooler takes 15 gpm. Starting motor takes about 200 kw for 10 min.

For a 10,000-kw base-load machine, Fig. 3, the low-pressure turbine has 7 blade rows and the generator is rated 3600-rpm 0.8-pf at 6300 v. The two starting motors require a toal of 450 kw for six minutes.

No intelligent comparison of gas-turbine power units can be made with other types of prime movers without some discussion of installation cost. While present values are by no means stabilized in Switzerland or in this country, engineers should have available firm cost values, as well as firm guarantees of thermal performance.

Under present manufacturing conditions in Switzerland, existing import duties and erection costs (but subject to determination of the European phase of the war during the year needed for shop manufacture) the complete units described here will cost from $67 to $94 per net kw, delivered and installed in this country. The smaller units, of course, cost more per kw than the larger range, even though the later require a multiplicity of heat-transfer equipment for higher efficiency. For the single-shaft machines the difference between 23 and 26% thermal efficiency involves $10 to $15 per kw for the larger heat exchangers.





BARTLETT-SNOW COAL HANDLING FOR *Industrial* BOILER PLANTS

● Forty-nine chances out of fifty—if you burn from 30 to 200 tons of coal a day, you'll find a Bartlett-Snow Coal Handling System will meet your requirements *better,— cost less,*— be installed and ready for operation *sooner.*

You see,— we studied scores of our most outstanding installations,— Then took the best ideas from these "best" jobs — and — with more than forty years experience in this work developed, and completely engineered, a group of "ideal" coal handling arrangements for different sizes and types of small, medium and large size industrial boiler plants.

Each of these systems combines maximum dependability with low maintenance and low operating costs — can be installed in existing or new buildings — and altered easily to meet any yard or track condition. Because the major — and most costly — design and engineering work has already been completed — and "written off"— the purchaser gets more equipment for less money — faster — with only a minimum of "starting-up" adjustments.

Our Bulletin No. 83 gives full details,— and contains much information of interest to works managers, engineers, and power plant superintendents. Send for a copy.

THE C. O. BARTLETT & SNOW CO.

6205 HARVARD AVENUE • CLEVELAND 5, OHIO

Engineering and Sales Representatives in Principal Cities

COAL HANDLING FOR CENTRAL STATIONS AND INDUSTRIAL BOILER PLANTS

TRACK HOPPERS • SKIP HOISTS • BUCKET ELEVATORS • BELT CONVEYORS
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METALOCK

THOUSANDS OF CRACKED AND BROKEN FERROUS AND NON-FERROUS CASTINGS, RUINED BEYOND ORDINARY REPAIR, NOW REPAIRED PERMANENTLY BY AMAZING METALOCK COLD PROCESS

Take a good look at that husky 6-LRO Waukesha frame, you power men! The section to the right of the white line was hopelessly broken. Yet Metalock experts, called in on the job, saved the situation by cutting off the broken end with a drill and Metalocking a good end from a salvaged frame in its place. The result? A perfect, permanent repair job with the frame true on top and bottom.

Metalock Repairs Adopted by Many Diversified Industries

. . The Metalock repair described is but one of thousands of successful jobs in many industries that Metalock licensed agencies in 23 cities are handling regularly on broken or cracked ferrous and non-ferrous castings, including Diesel engine heads, engine cylinder liners, flywheels, crankshafts, steel forgings, etc.

. . Metalock does the job better *in less time* than ordinary repair methods, because it is a *cold repair process*. Absolutely no heat is used. It renews strength with safety factor, maintains alignments (no distortion), makes machining unnecessary, stops leaks, redistributes stresses, eliminates stress points, corrects fatigue.

Repairs are made on or off location—and are unconditionally guaranteed.

Many repairs now being made for the armed forces. Approved by Hartford Insurance, American Bureau of Shipping, etc. "Metalock," "Masterlock," "Metalace" and "Metalaze" trade-marks registered, patented, patents pending.

METALOCK REPAIRS MADE AT ANY OF THE FOLLOWING LICENSED AGENCIES:

302 North Ludlow St.
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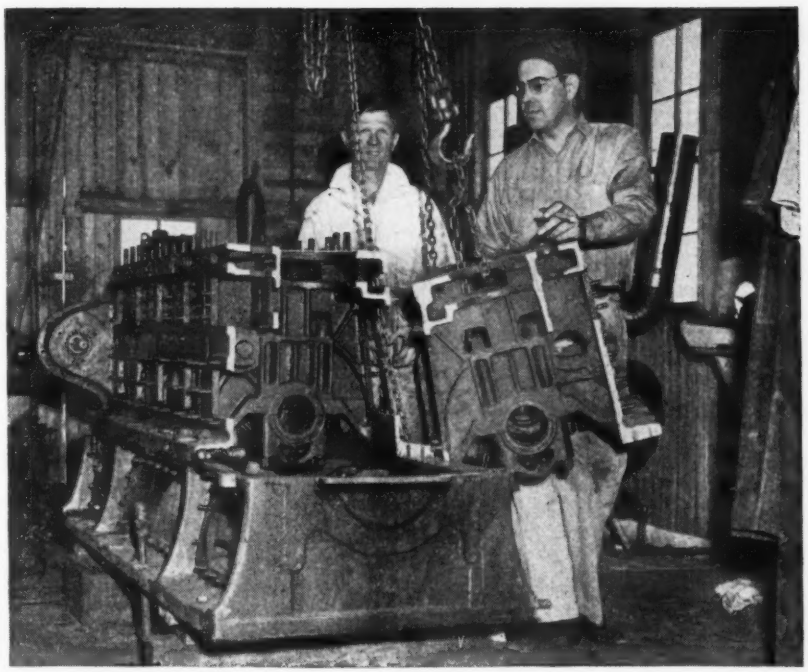
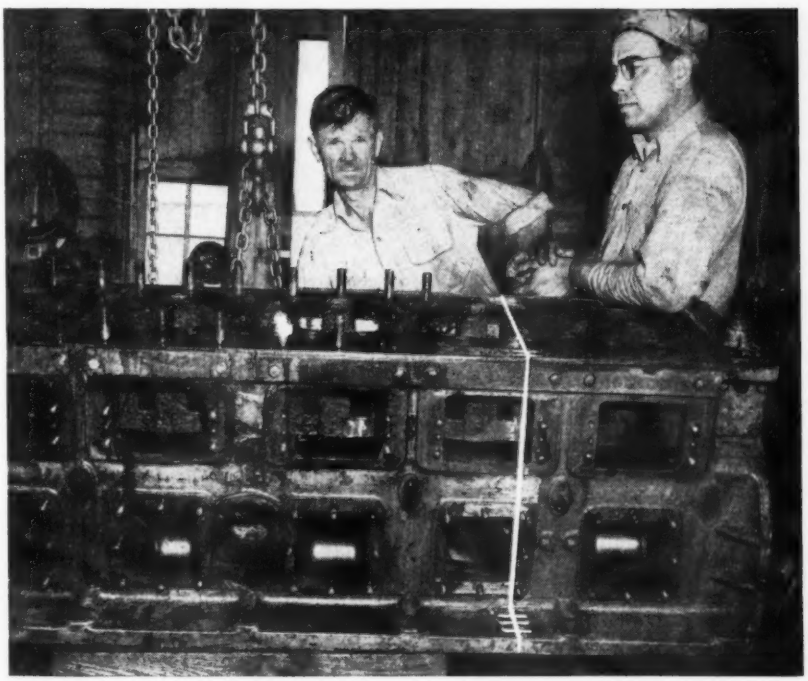
METALOCK CASTING REPAIR SERVICE
BOX 314 COLUMBUS, OHIO

COLD REPAIR PROCESS SAVED THIS BROKEN CASTING



BROKEN 6-LRO WAUKESHA FRAME

Broken end was cut off and replaced with salvaged good end from another frame. Crankshaft and cam shaft were checked for alignment and were installed in place without using any shims in the mains.



SAME FRAME AFTER METALOCK REPAIR

The white line shows where the new frame end was Metalocked in place. After the repair, a feeler's guage would not slip between the frame and pan. Metalock, Masterlock and Metalace cold processes were used in completing this amazing money-saving repair.

METALOCK IS THE MOST SCIENTIFICALLY ADVANCED COLD REPAIR PROCESS NOW IN USE — UNCONDITIONALLY GUARANTEED

You'll Save with

SIMPLICITY OF DESIGN
MEANS
EASIER MAINTENANCE

BRONZE, IRON, STEEL AND CORROSION-RESISTANT ALLOY VALVES

LUNKENHEIMER
VALVES

Economy in performance is the first essential of Lunkenheimer valve design . . . every detail is carefully thought out and coordinated to insure tightness and long service life with lowest possible outlay of time, labor and money for maintenance.

Glance at the chart immediately following. These startling figures show what leaky valves can waste . . . and conversely what good, tight valves can save. Where Lunkenheimer valves are on the job and given ordinary care, these losses are held to a bare minimum. (Enlarged copies of the chart for posting in your plant are available on request.)

Always helpful is the nation-wide Lunkenheimer distributor organization. There's one near you with complete facilities to serve you.

AREA OF LEAK	AIR		STEAM		WATER	
Diameter Inches	Number of cubic feet per month at 75 lb. pressure	Total cost of waste per month 11c per 1000 cubic feet	Pounds wasted per month at 160 lb. pressure	Total cost of waste per month 65c per 1000 lb.	Gallons wasted per month at 60 lb. pressure	Total cost of waste per month 16c per 1000 gallons
1/2"	13,468,000	$1,481.44	1,219,280	$792.53	1,524,100	$243.86
3/8"	7,558,500	831.44	684,290	444.79	855,360	136.86
1/4"	3,366,990	370.37	304,820	198.13	381,020	60.96
1/8"	824,570	90.70	74,650	48.52	93,310	14.93
1/16"	213,000	23.43	19,280	12.53	24,110	3.86
1/32"	52,910	5.82	4,790	3.11	5,990	.96

ESTABLISHED 1862

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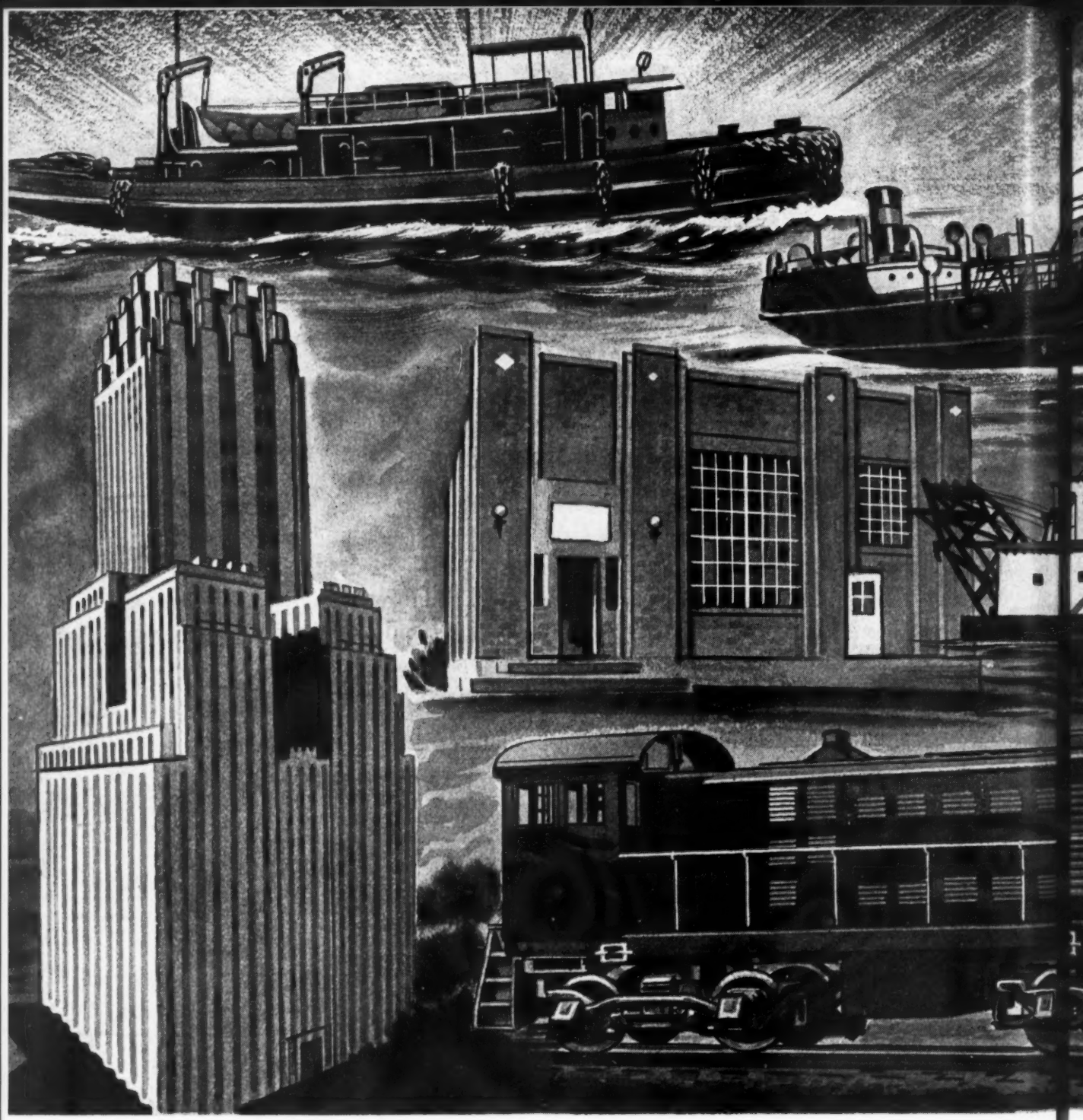


POSTWAR PRIME MOVER

More than 1,500,000 horsepower of ALCO Diesel engines are installed today. Improvements consistently developed by ALCO will make ALCO engines more than ever the choice of the post-war world.

For years heavy-duty Diesel engines were needlessly massive. ALCO ended this...eliminated thousands of pounds of cast iron...came up with a better, more rugged, more dependable engine. Other makers followed suit. But ALCO *led the way.*

There used to be a notion that heavy-duty Diesel engines had to run slowly. ALCO scrapped this fallacy, too ...brought out a high-speed engine, with more power per pound, more power per cubic foot of space occupied, plus higher efficiency. An engine with stamina, endurance, for any service...extra-hard jobs of any kind. Today, this principle is utilized by other builders.

But ALCO *led the way.*

ALCO leadership is reflected in the phenomenal acceptance of this new ALCO engine. More than 1,500,000 horsepower have been installed in utility power plants, locomotives, hospitals, pumping stations, factories, dredges, tugs, fireboats, freighters, naval vessels, ferryboats—an amazing range of applications.

Now all ALCO Diesel engines are needed for war. When they do become available, ALCO will unveil even greater improvements...add still more to the benefits you will gain by using truly modern Diesel power for your postwar power needs.

American Locomotive

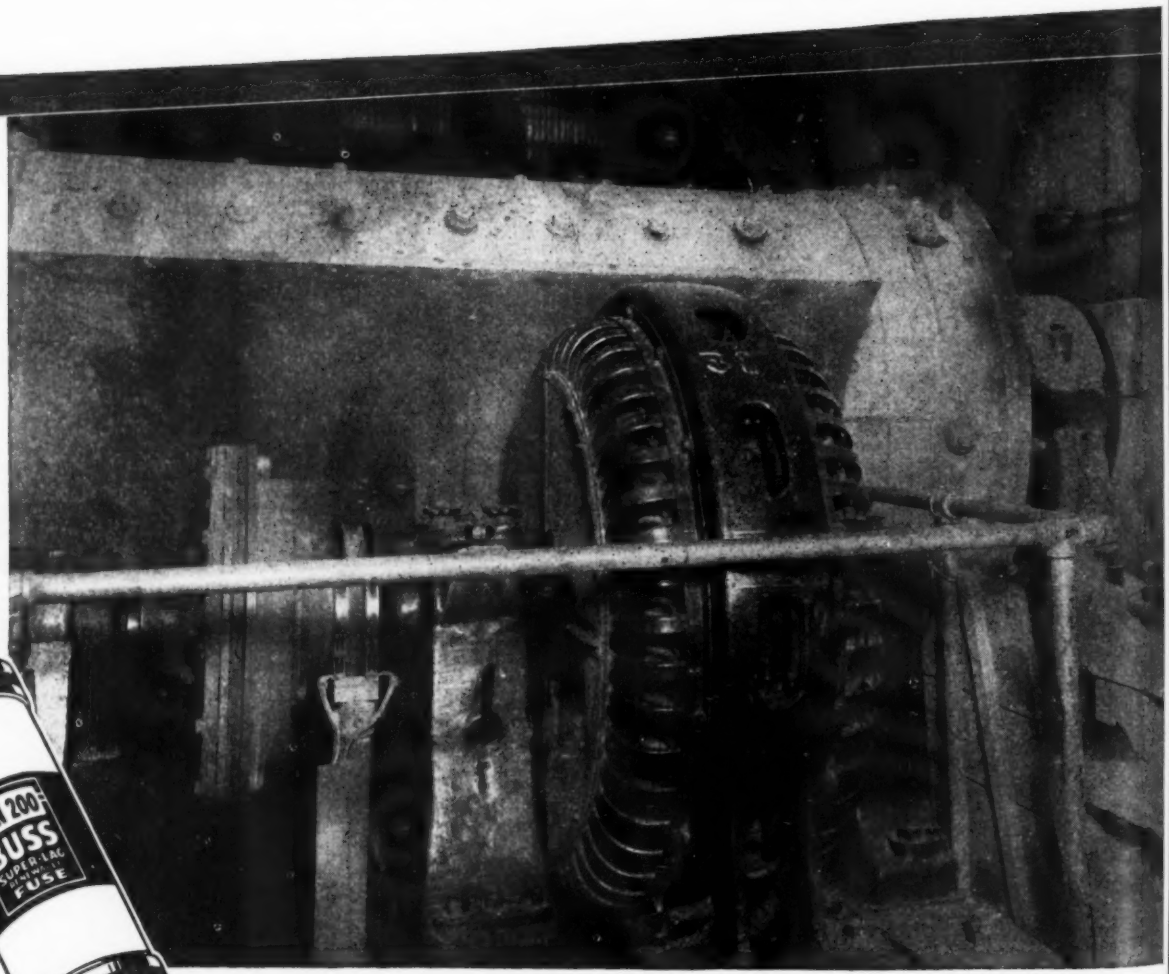
ALCO DIESEL ENGINES

for Universal Application

30 Church St., New York 8, N. Y.

"We Reduced Fuse Maintenance and Eliminated Costly Shutdowns —on our Tube Mill with BUSS Super-Lag Fuses"

Reports Mr. H. W. Smith, Vice Pres. in charge of Operations
Riverton Lime & Stone Co., Riverton, Virginia



BUSS SUPER-LAG

SOLD THROUGH WHOLESALERS

Mr. Smith explains—"Several years ago costly shutdowns on our tube mill were occurring much too frequently due to fuses blowing. A salesman suggested that BUSS Super-Lag fuses might correct the trouble. After installing them we stopped having needless fuse blows. We credit the long time-lag of BUSS fuses with preventing these interruptions of our production as well as with greatly reducing our fuse maintenance costs."

TIME AFTER TIME in plant after plant, the use of BUSS Super-Lag fuses has reduced fuse maintenance, saved production time, saved money, and kept production up. You, too, can get the same result by using BUSS Super-Lag fuses. The experience of the Riverton Lime and Stone Company is one of a long list of successful installations that proves that fuse blowing on harmless overloads can be reduced by using BUSS Super-Lag Fuses.

BUSS fuses require no maintenance or periodic inspection. They don't open needlessly. If one opens, you can be sure some condition needs correction. When one opens, it requires less than 45 seconds to renew with an inexpensive link.

Here is why BUSS fuses greatly reduce or entirely prevent needless blows

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus excessive heating which causes fuses to blow needlessly is prevented.

The fuse link used is the famous "BUSS Super-Lag." It has lag-plates attached to it. These give it a time-lag so long that it will reduce to an extent not possible with any other renewable fuse, the number of Shutdowns caused by needless fuse blows.

How to solve the "shutdown problem"

Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses afford. BUSSMANN MANUFACTURING CO., University at Jefferson, St. Louis, Missouri. *Division McGraw Electric Company.*

FUSES

Why BUSS Fuses Don't Blow Needlessly

10 FEATURES in the design of the FUSE-CASE help make it possible.

and

***The* SUPER-LAG** development in the FUSE-LINK completes the job.

3 FEATURES

The British Air Ministry had to make quick decisions in 1939. War appeared imminent and the aviation gasoline problem was critical.

Universal Oil Products Company was given the assignment of designing high capacity gasoline plants. Only limited quantities of critical materials were available for new plants. Consequently the use of the most modern refining processes would be essential to supply quantities of gasoline large enough for R. A. F. needs. Also, these processes would have to utilize the available base stocks to best advantage. The greatest significance had to be attached to the design and selection of all equipment. Both process-design and equipment had to be unsurpassed in dependability.

Three outstanding features caused Bigelow-Liptak linings to be chosen for this vital aviation gasoline plant.

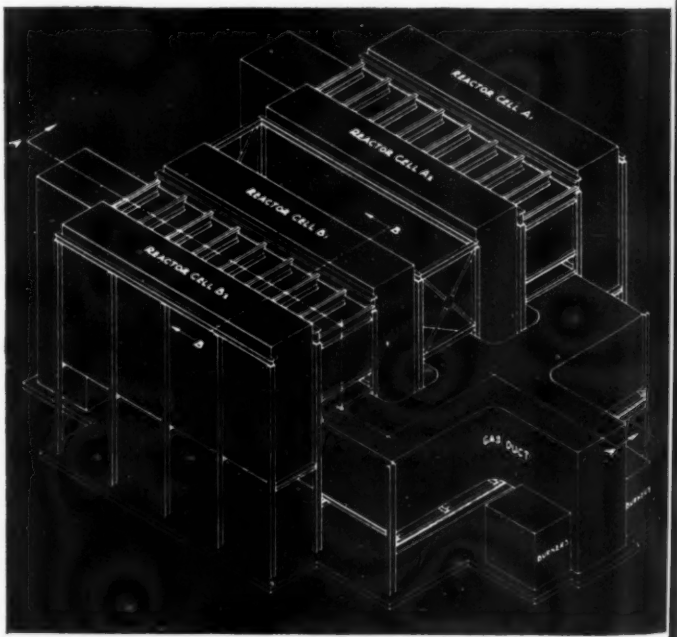
---

one Suspended walls would be an essential part of the design because of the complicated cellular structure of the furnaces and reaction chambers. No known construction adapts itself so readily to small irregular areas, curved construction, etc., nor resists strains from moving dampers, etc., as does Bigelow-Liptak Unit-Suspended construction.

two Lining should have low heat storage because of frequent cycle changes. Bigelow-Liptak had previously developed and applied a special type of suspended wall adapted to the use of light weight or insulating type of refractory. This design embodied all Bigelow-Liptak Unit-Suspended features thereby eliminating the cumulative loading of the fragile refractories and likewise eliminating the expansion movements resulting from such cumulative loading.

three Plant had to be designed and coordinated in Universal Oil Products Company's Chicago office with materials supplied and construction executed in Britain. Bigelow-Liptak is an international organization with a fully qualified associate company in the British Isles. Coordination and construction of the approved design was therefore practically as simple for Bigelow-Liptak as it would be in any American city. Bigelow-Liptak would be able to develop the design in Chicago and turn it over to its British Associate for execution.

Based on these three valuable features, plus wide experience in this type of design Bigelow-Liptak engineering was selected. Complete designs were made and flown to London by Clipper. As a result of these Bigelow-Liptak advantages, the plant was constructed in record time and has performed to the complete satisfaction of all.



This general isometric view of one reactor cell block gives a general idea of the unusual areas to which suspended wall and arch construction had to be applied and the probable expansion movements to be provided for.

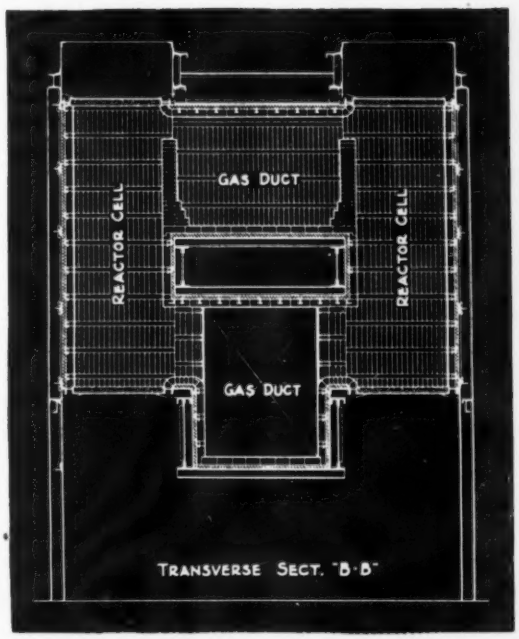
Do You have an Enclosure Problem?

Bigelow-Liptak engineering is today solving new and old problems in all types of heat enclosures. Its record of successful installations through the years and its ability to solve new problems as they arise are based upon individualized engineering for each problem and the application of sound engineering principles that will give the user the best and most economical solution to his particular needs.

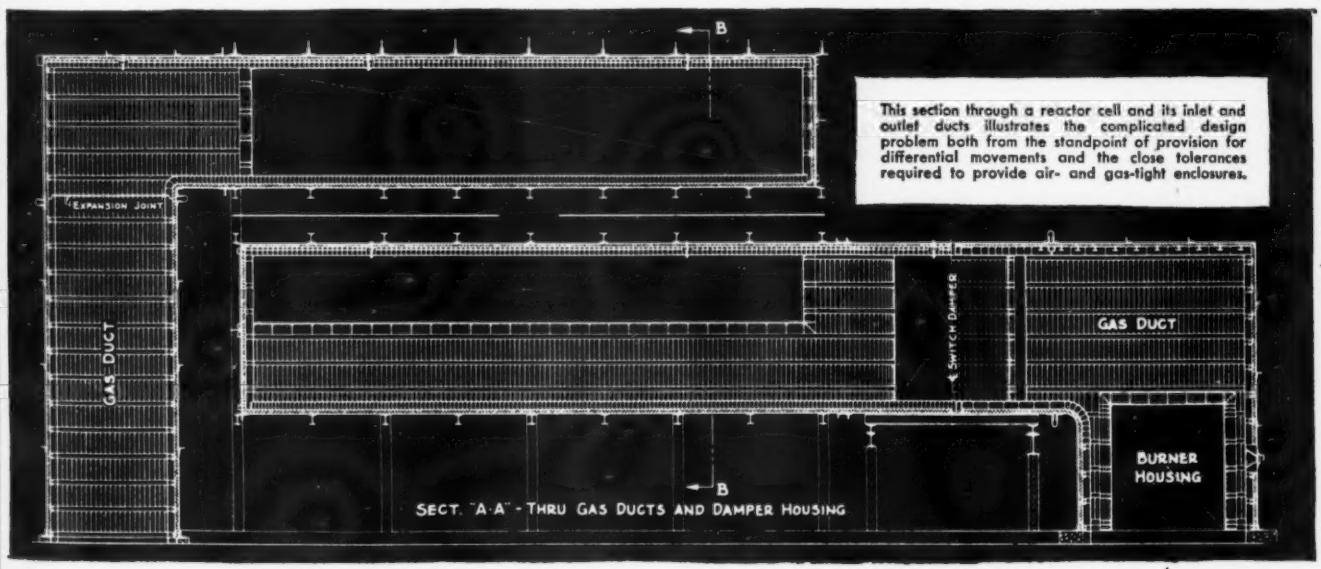
that caused BIGELOW-LIPTAK reactor enclosures to be chosen by British aviation gasoline plants

What this means to you:

The significance of this problem and its complete solution by Bigelow-Liptak is much greater than any resemblance it may have to any of your problems. It serves to demonstrate the value you may receive by taking your problems to Bigelow-Liptak regardless of their type, size or location. Bigelow-Liptak's wide experience in designing enclosures includes every type of problem having to do with thermo-dynamics, ceramics and mechanics of materials. With Bigelow-Liptak there is no standard or set solution for every case. Individualized engineering, based on years of experience and sound engineering principles, is applied toward giving the customer the best and most economical solution to his particular needs. Our policy is to give first and foremost consideration to the needs of the user.



This cross-section through one cell gives a general idea of the complicated gas flow. The process parts of the cells are of course not shown for obvious reasons.



This section through a reactor cell and its inlet and outlet ducts illustrates the complicated design problem both from the standpoint of provision for differential movements and the close tolerances required to provide air- and gas-tight enclosures.

BIGELOW LIPTAK Corporation

Unit-Suspended Walls + Arches

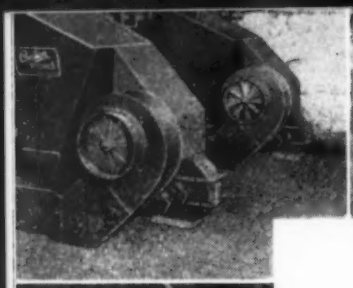
The Key to Operating Economy

BIGELOW-LIPTAK CORPORATION

DIVISION A. P. GREEN FIRE BRICK CO.

300 Curtis Building

DETROIT



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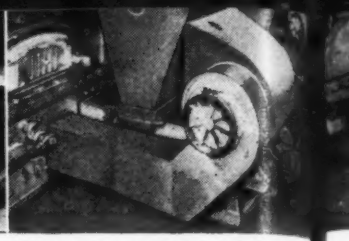
EUCLID ROAD MACHINERY CORP., CLEVE



U. S. NAVAL AIR FACILITIES, COLUMBUS, O

MORIN HEIGHTS HOUSING PROJECT, WOONSOCKET, R. I.

GRIFFIN MANUFACTURING CO., BROOKLYN, N. Y.

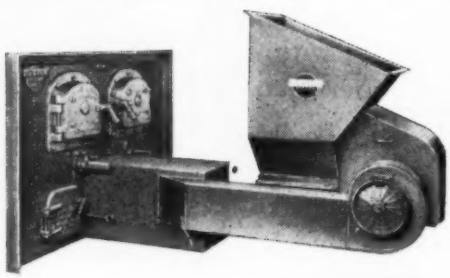
E. & W. DYEING CORP.

THERE ARE 54 TYPES AND SIZES OF

CANTON STOKERS

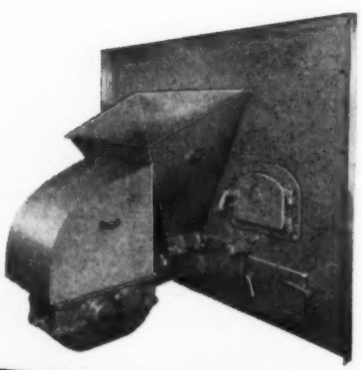
TO MEET *YOUR* REQUIREMENTS

HERE ARE THE THREE BASIC DESIGNS . . .



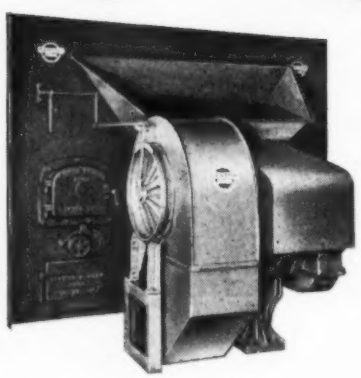
DURAFLEX

A wormfeed stoker for industrial and commercial installations with many features usually found only on ramfeed designs. Especially adapted to boilers developing up to 175 H.P., the Duraflex includes the refinements of a large active grate area, side ash dumping plates and zoned windbox. Separate fan drives and full furnace fronts are standard auxiliaries always available. Write for Bulletin No. 500.



LO-SET

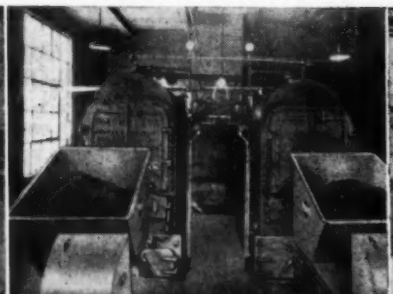
A compactly designed Heavy Duty Ramfeed stoker that has saved expensive furnace alterations and pitting for installation on scores of jobs. Built with a safety factor of 5 to 1 for developed loads of 450 H.P., the LO-SET will easily carry over-ratings up to 200%. Hi-Firebox heating and power boilers, designed to avoid furnace refractory, are successfully fitted with Canton Lo-Set Stokers. With Canton Synchronized Combustion Control, this unit will swing from 50% to 200% of boiler rating without manual attention. Request Bulletin No. 400.



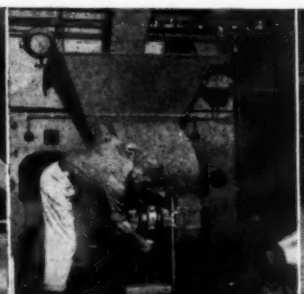
VULCAN

All Custom Built, these Stokers carry the heaviest industrial loads in continuous duty service. On either electric or steam drives they develop 800 H.P. or more, and with Canton Synchronized Combustion Control require no manual attention in shifting from 50% to 200% of rating. An extremely rugged, dust-proof gear box drives the Stoker through oversize bearings, gears, and sprockets with a safety factor of 5 to 1. Wearing surfaces are alloy-hardened and many parts are practically indestructible. Full information is offered in Bulletin No. 200.

PATERSON, N. J.

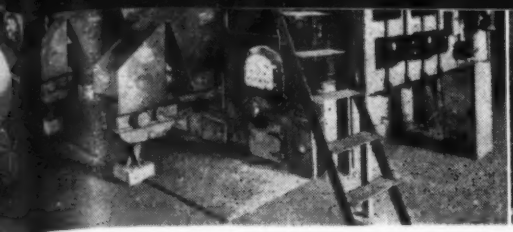


FERRO-ENAMEL CORP., CLEVELAND

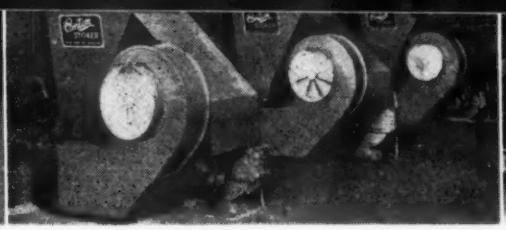


PAGE LAUNDRY, WASHINGTON, D. C.

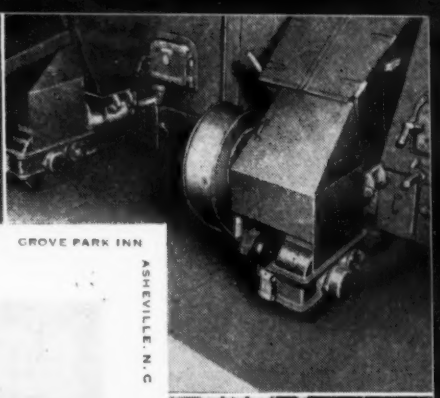
GESU CHURCH, CLEVELAND, OHIO



NORTON AND COMPANY, ALEXANDRIA, VIRGINIA

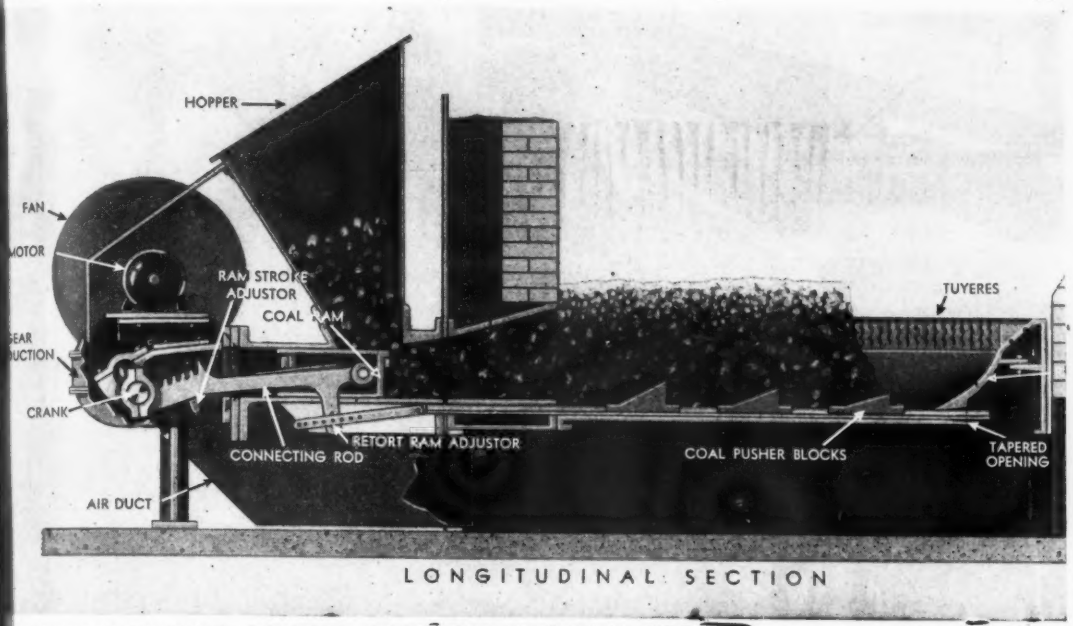


GENERAL HOSIERY COMPANY, FT. WAYNE, IND



GROVE PARK INN

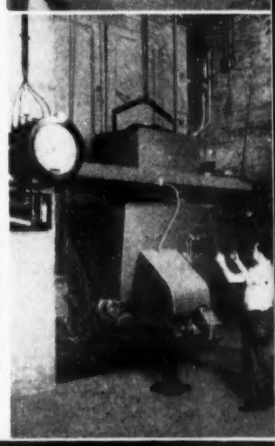
ASHEVILLE, N. C



LONGITUDINAL SECTION

NEWBURGH AND SOUTH SHORE RAILWAY

VICTOR SILK HOSIERY, NEW BRITAIN, PENNA



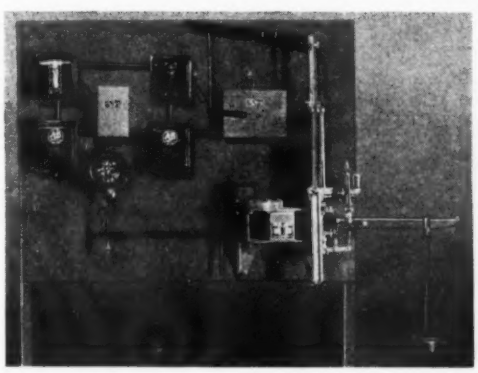
SHOREHAM HOTEL, WASHINGTON, D. C

HIS X-RAY VIEW OF THE CANTON VULCAN STOKER *gives the inside facts on the simplified, powerful mechanism. Coal is loaded into V-shaped Hopper by hand or conveyor system, and falls by gravity down to Coal Ram. The Coal Ram is driven in a reciprocating action by the Crank, allowing coal to fall in front of Coal Ram on back stroke, and pushing it into Furnace on forward stroke. The highly efficient mounting of motor and gears delivers maximum power to the Coal Ram, which easily crushes wood, slate, and small pieces of foreign matter, feeds them into Furnace, and thus eliminates usual causes for stoppage. After passing through Throat, coal is distributed and levelled over the entire area of the Furnace by a Retort Ram with Pusher Blocks, adjustable for any kind or size of coal.*

CANTON STOKERS SAY IT WITH SERVICE—AND BACK IT UP WITH A FIVE YEAR GUARANTEE

CANTON STOKERS

Synchronized Combustion Controls-- For automatically varying coal feed, forced draft and boiler draft to follow efficiently steam demand.



All working parts not exposed to the fire are covered by a five year guarantee applying not only to defects, but actually wear itself. Only because these Stokers are built stronger at vital points, from superior materials, do they merit such a guarantee. A corps of travelling service engineers assists and advises Canton Stoker owners in securing best results.

Now IMMEDIATE DELIVERY FROM STOCK

TO REPLACE OIL, GAS, OR HAND FIRING EQUIPMENT

Send for Descriptive Literature and Cost Saving Facts

11 STORY RENKERT BLDG., CANTON, OHIO

HUMBOLDT DYE WORKS, BROOKLYN, N. Y.

CANTON STOKER CORPORATION

741 ANDREW PLACE, S. W., CANTON, OHIO

Gentlemen:

___Please send all descriptive literature at once

___Have a CANTON Engineer interview us immediately

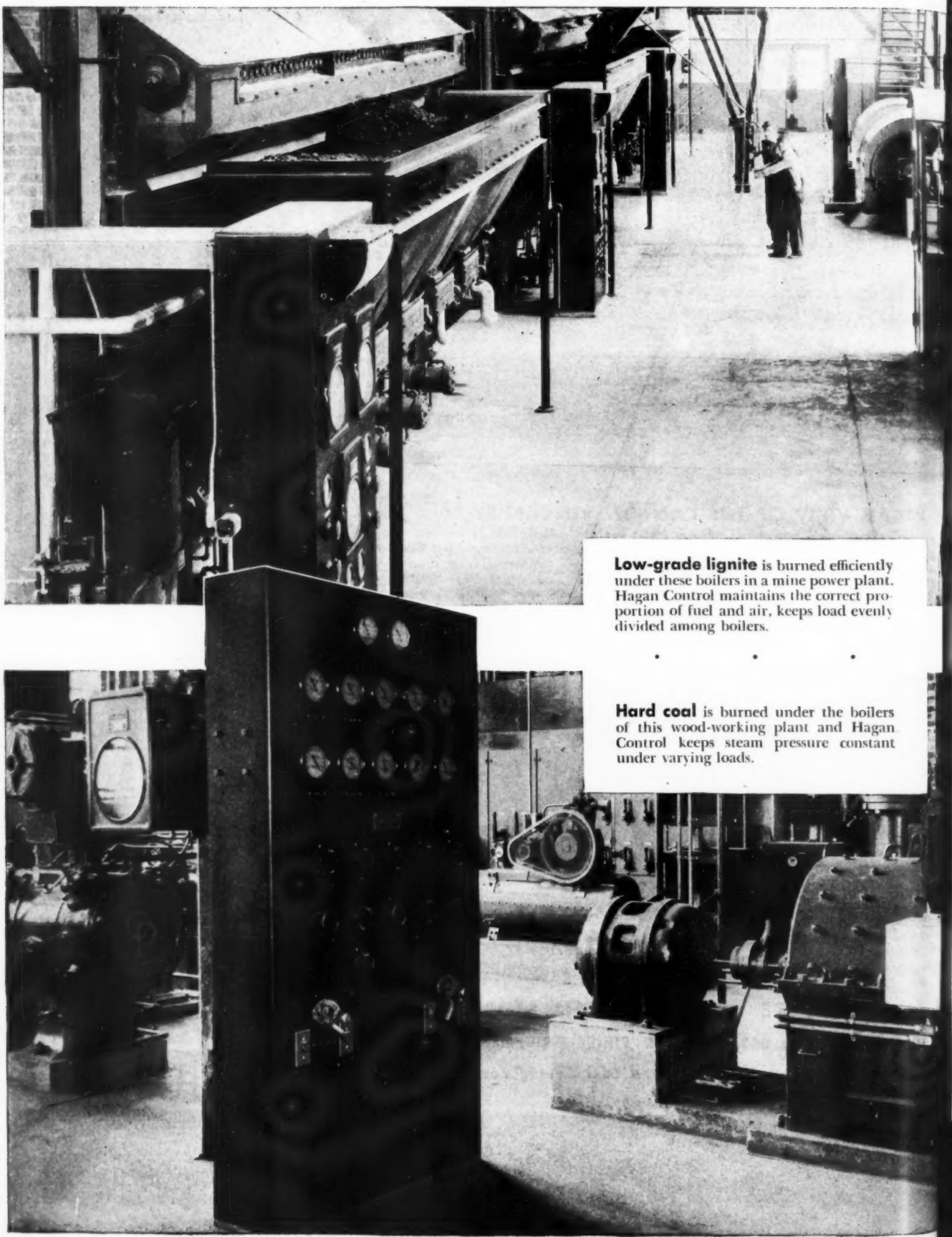
Name _____

Company _____

Address _____

City_____ State_____

IF YOU BURN COAL, OIL,



Low-grade lignite is burned efficiently under these boilers in a mine power plant. Hagan Control maintains the correct proportion of fuel and air, keeps load evenly divided among boilers.

• • •

Hard coal is burned under the boilers of this wood-working plant and Hagan Control keeps steam pressure constant under varying loads.

GAS, TAR ... even sawdust!

HAGAN CONTROL will give you maximum efficiency

THE use of waste materials as boiler fuel serves the dual purpose of saving money for you and of helping the program for the conservation of our natural fuels—coal, oil and natural gas. This has been accepted as standard procedure in some industries for many years, but the possibilities for further savings are to be found in nearly every industry.

Hagan Combustion Control has been responsible for a considerable portion of savings heretofore realized. It was the first system to be used for control of simultaneous firing of multiple fuels—blast furnace gas, coke oven gas and pulverized coal.

Today, the up-to-the-minute version of the same control—engineered to fit into the plant requirements—is ready for application to your problem.

Typical installations are operating with coke breeze as the base fuel and using coke oven gas for auxiliary firing—both controlled automatically.

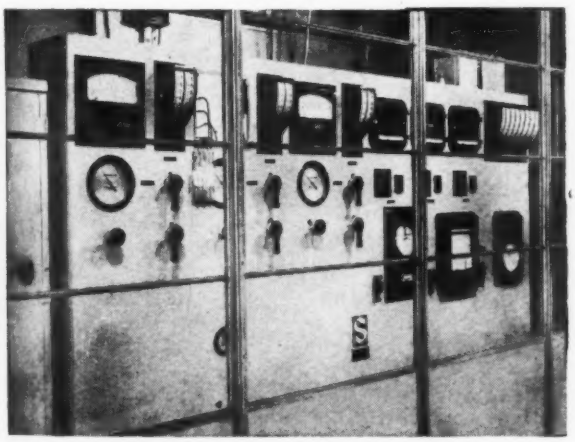
Blast furnace gas is used in other plants, up to the limit of availability, with coal controlled automatically to make up total fuel requirements.

Refinery gas, with a wide range of heat value, is being used with auxiliary fuels—various combinations of fuel oil, natural gas, coal and acid sludge.

Sawdust and hog fuel, with either coal, oil or gas, is a combination coming into wider application.

All of these are controlled economically and efficiently by Hagan Control.

It will pay you dividends to check the possibilities in your own plant—*NOW!* Hagan engineers are ready to help you find the best combination of equipment.



Coke-oven gas or natural gas fires these steel mill furnaces and Hagan Control helps speed up heating.

HAGAN CONTROL ASSURES

MAXIMUM QUANTITY of steam from any given plant, by introducing fuel and air in correct proportion (for high efficiency.)

MAXIMUM UTILIZATION value and uniform steam pressure.

MAXIMUM OUTPUT from boilers of differing capacities.

MAXIMUM PROTECTION of auxiliary equipment, fans, stokers, etc., by maintenance of uniform operating conditions.

HAGAN
HALL
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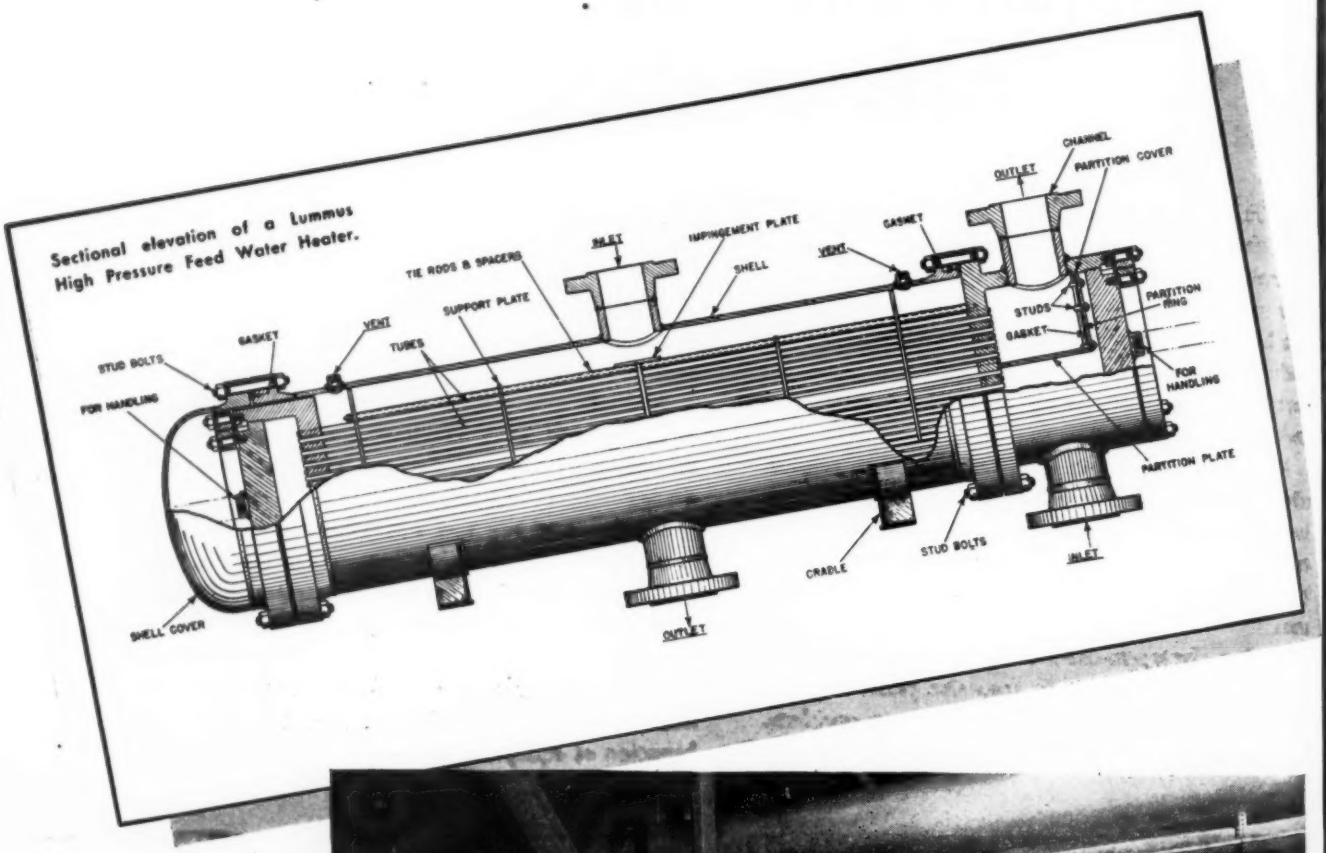
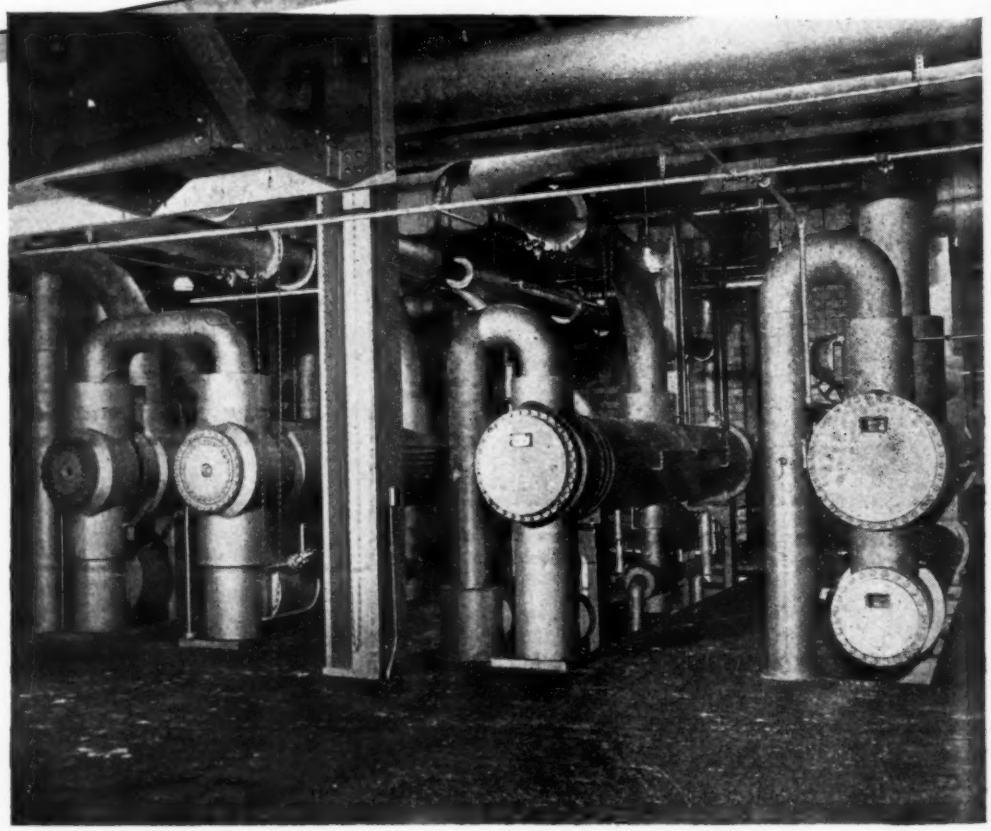
HAGAN CORPORATION · HAGAN BUILDING · PITTSBURGH, 30, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

DESIGNED and





FEED WATER HEATERS and HEAT EXCHANGER: Left to right, the installation consists of—*Two high pressure feed water heaters:* design pressure of 1,100 psi; tested at 2,200 psi on the tube side: effective surface areas, 935 and 1,355 square feet respectively. Each employs the Lummus MULTI-LOCK (patented) CLOSURE for the channel and floating heads as shown in the sectional drawing. *One intermediate pressure heater* and *one low pressure heater* employing conventional pull-through floating head construction: effective surface areas, 1,310 and 1,750 square feet respectively. *One feed water-condensate exchanger:* fixed tube sheet construction; effective area, 1,040 square feet.

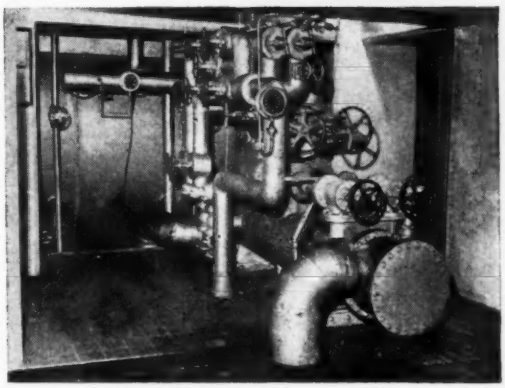
BUILT by LUMMUS

for Ohio Edison Company

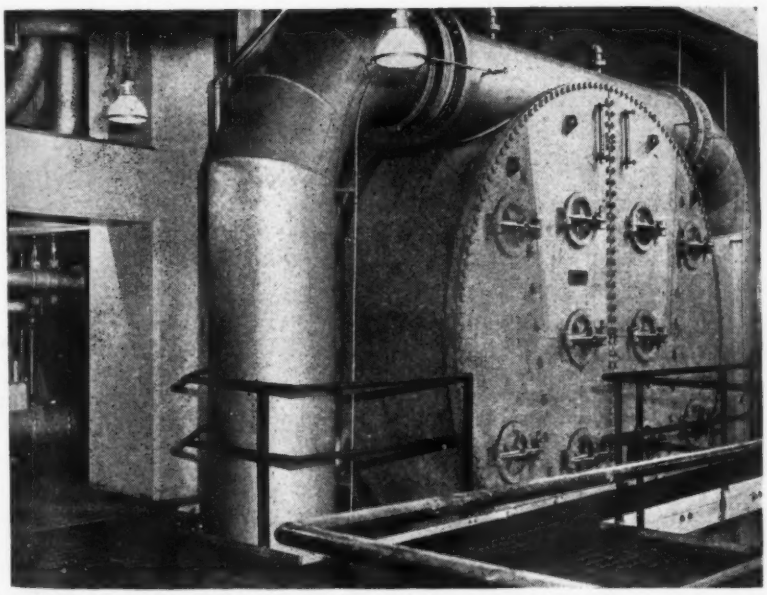
Lummus Equipment . . . for the new unit having a capability of 44,000 KW installed in the Gorge Power Station of Ohio Edison Co. on the Cuyahoga River, Akron, Ohio, is in dependable base load operation furnishing service to important war industries, cities and communities in Northeastern Ohio.

Lummus engineering service is always available for the study of specific heat exchanger problems for power plant modernization and post war requirements. For further information write to:

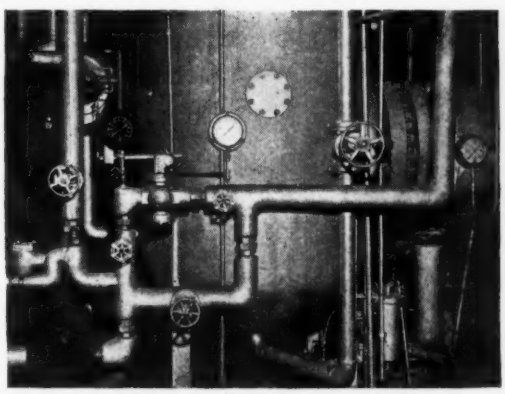
THE LUMMUS COMPANY • 420 LEXINGTON AVE., NEW YORK 17



STEAM JET AIR PUMP: Two-stage, twin element unit with surface type combined inter-and-after condenser. Each twin element evacuates 58 pounds of dry air per hour. Vacuum is maintained at 29 inches Hg, referred to 30-inch barometer.



SURFACE CONDENSER: Designed with an effective surface of 32,600 square feet to condense 350,000 pounds of steam per hour. Vacuum is maintained at 27.87 inches Hg, referred to 30-inch barometer.



EVAPORATOR: Vertical construction with U-tube bundle; effective surface area 406 square feet; evaporating capacity, 12,000 pounds of water per hour.

LUMMUS

HEAT EXCHANGERS

LUMMUS POWER PLANT EQUIPMENT

SURFACE CONDENSERS
STEAM JET AIR EJECTORS
BLEEDER HEATERS
BOILER BLOWDOWN HEAT EXCHANGERS
EVAPORATORS
FUEL OIL HEATERS
LUBRICATING OIL COOLERS

Powell's Past ...your assurance of Future Performance

For every problem in flow control, there'll always be a POWELL Valve to lick it!

Powell Valves for controlling the flow of power were not just "born"—they're a product of evolution—the result of nearly a century of patient study, research and experimentation by Powell's staff of Engineers and Metallurgists. That's why you can be sure TODAY that TOMORROW—as in the past—there'll always be Powell Valves correctly designed and engineered to meet every new requirement for dependable flow control in the vast field of power. The valves shown here are especially adapted for intermediate steam, water, oil or gas lines. For pressures up to 2500 pounds W. S. P. and temperatures up to 1400 F. Powell has a complete line of Cast Steel Valves of every type.

Fig. 375—Bronze Gate Valve for 200 pounds W.S.P. Has screwed ends, inside screw rising stem, union bonnet, and renewable nickel-bronze taper wedge solid or double disc.

Fig. 560—Bronze Regrinding Swing Check Valve for 200 pounds W. S. P. Has screwed ends, screwed cap and regrindable, renewable bronze disc.

POWELL

Fig. 500—Bronze Gate Valve for 125 pounds W.S.P. Has screwed ends, inside screw rising stem, screwed bonnet and renewable taper wedge solid or double disc.

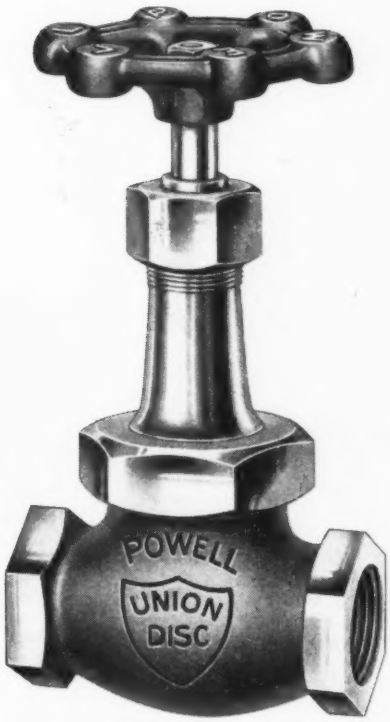


Fig. 150—Bronze Globe Valve for 150 pounds W.S.P. Has screwed ends, union bonnet and renewable composition disc. (Discs of vulcanized rubber, phenolic resins, soft metal and bronze can be supplied to meet various service requirements.

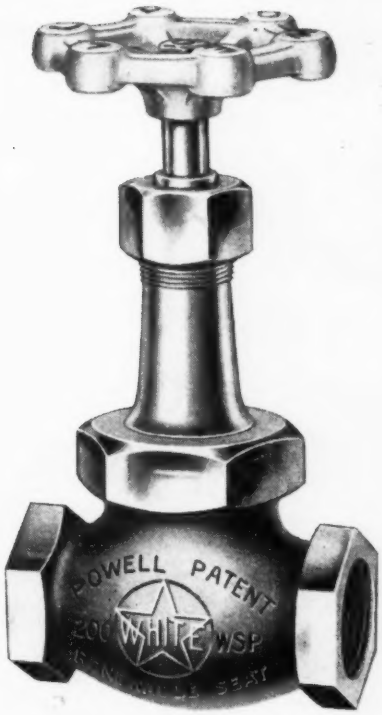


Fig. 1708—Bronze Globe Valve for 200 pounds W.S.P. Has screwed ends, union bonnet, renewable seat and regrindable, renewable nickel-bronze semi-cone plug type disc.

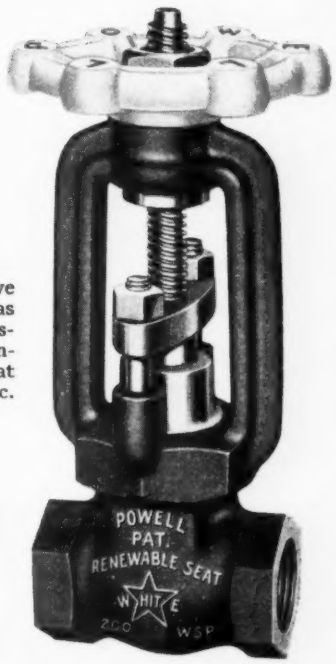


Fig. 386—Bronze Gate Valve for 200 pounds W.S.P. Has screwed ends, outside screw rising stem, screwed yoke and bonnet, renewable nickel-bronze seat rings and taper wedge solid disc.

The Wm. Powell Company

Dependable Valves Since 1846

Cincinnati 22, Ohio

VALVES

ROTO Tube Cleaners

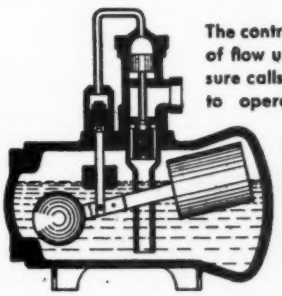
Especially handy inside drums and other tight spots

ROTO
Air Valve

With a Roto Tube Cleaner your operator doesn't have to worry about a helper to turn air on and off. The operator himself controls the entire operation with an air valve located directly behind the motor. You will appreciate the benefits of one-man control because it provides safer, more efficient tube cleaner operation, especially inside drums and other tight spots. Write for details.

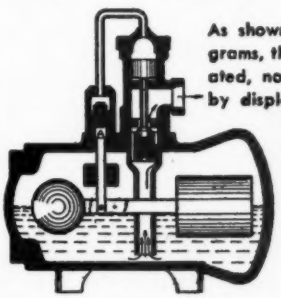
The Roto Company
145 Sussex Avenue, Newark 1, N. J.
A DIVISION OF ELLIOTT COMPANY

How to Handle Condensate Drainage at High Pressures

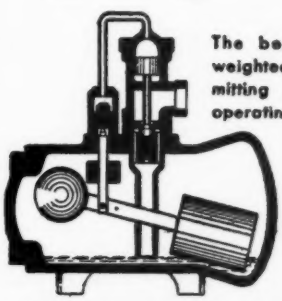


The control of a high rate of flow under high pressure calls for great force to operate the valve.

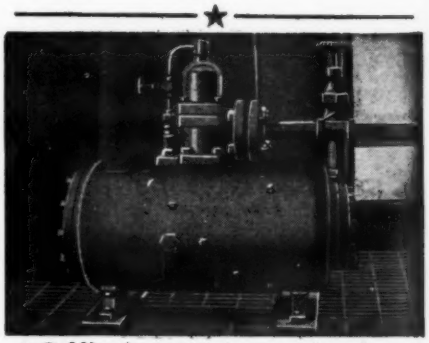
In the Cochrane Discharger this force is provided by a piston actuated by a pilot valve.



As shown in these diagrams, this pilot is operated, not by floats but by displacement bodies of different densities at either end of a beam which tilts with the rise and fall of the water level.



The beam opens the weighted pilot valve admitting steam to main operating valve which instantly opens main discharge valve to full opening, avoiding wire drawing or chatter.



Publication 2935 gives complete data.

COCHRANE CORPORATION
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STEAM SPECIALTIES

ALLPAX

THE PACKING THAT "PACKS ALL"

. . . use it once and . . . you'll use it always

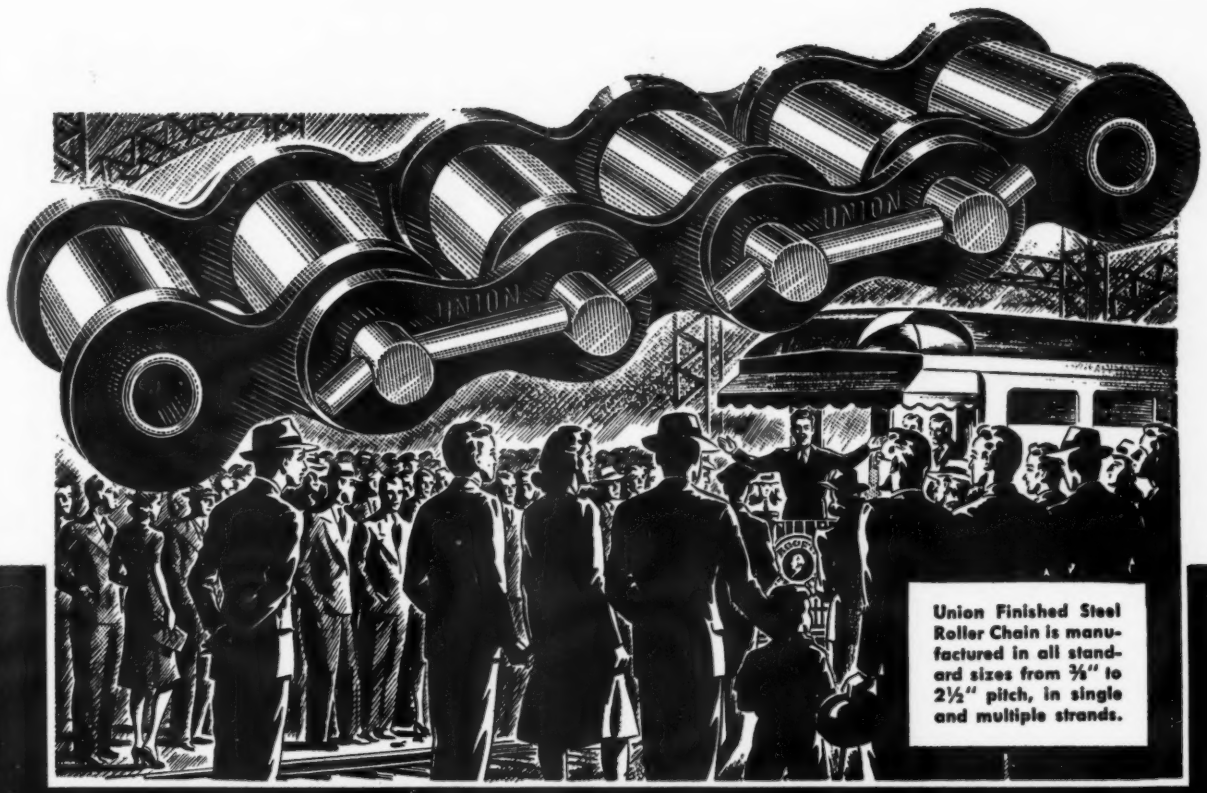
Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all—economically, efficiently—tightly—simply.

Try ALLPAX and you, too, will be enthusiastic over its easy application and long wear. You don't have to remove old packing to repack with ALLPAX. Square cross section makes ALLPAX easy-filling in any stuffing box.

Try it and you'll always use it. Full details on request.

THE ALLPAX CO., INC.
Mamaroneck, N. Y.

Distributors Everywhere



Union Finished Steel Roller Chain is manufactured in all standard sizes from ⅜" to 2½" pitch, in single and multiple strands.

This Candidate Pulls

☆ In the excitement of this Presidential Campaign it is interesting to remember that products of all kinds are constantly campaigning for the preferences of buyers.

So it is with Union Chains. They are candidates for the opportunity to win the votes of additional chain users. Union Chains are good campaigners, when used in trial applications, they almost always make a hit, and they become even more popular as they continue to render trouble-free service year after year. Get acquainted with Union as a working candidate for your chain requirements. Write for Union Catalogs today, or send specifications covering any specific chain problem with which you are confronted.

The Union Chain and Manufacturing Company ..... Sandusky, Ohio, U. S. A.

Union Catalog A-2 covers Drive and Conveying Chains. Catalog B-2 covers Finished Steel Roller Chain and Sprockets. Ask for your copies.

UNION CHAINS

Union Chains for Every Application

Drive and Conveying Chains and Sprockets

- Bridge Chain
- Combination Malleable Iron and Steel Chain
- HB (hardened bearing) type chain
- BP (bar and pin) type chain

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Finished Steel Roller Chains and Sprockets

- All manufacturer's standard, size ⅜ in. to 2½ in. pitch
- Single and Multiple Strands
- Extended Pitch Series in sizes 1¼ in. to 4 in. pitch

★

Silent Chain and Sprockets

- All sizes ⅜ in. to 1½ in. pitch

★

Flexible Couplings

- Roller chain type
- Silent chain type

Make Your Overhead Valves SAFE And Easy to Reach---

With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.

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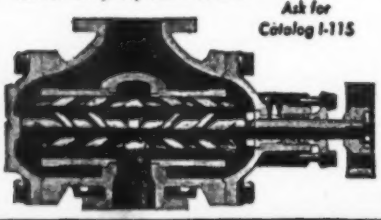
IMO Reliability IN NAVAL SERVICE

The reliability of IMO "lube" and fuel oil service pumps is typified by their trouble-free performance on a United States Destroyer reported to us by the Navy as having steamed over 84,000 miles on convoy duty during the past year, often cruising as much as 28 days per month without time for normal upkeep and overhaul.

Ask for Catalog I-115



IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton 2, New Jersey

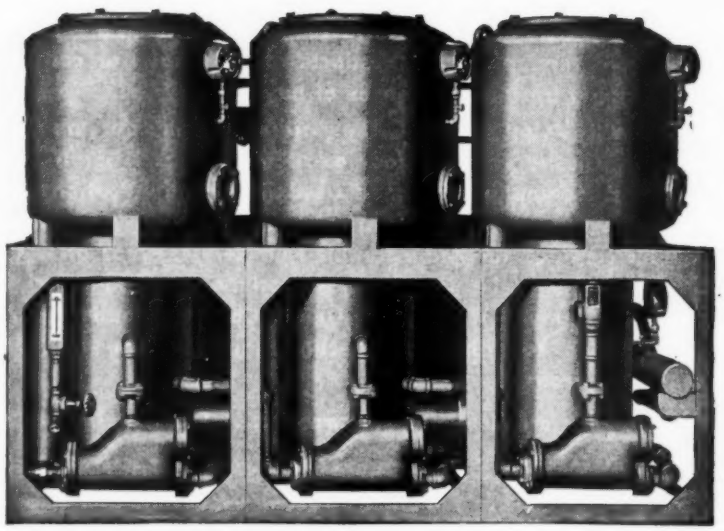
THINKING ABOUT AN ABUNDANT PURE WATER SUPPLY?

Investigate the HENSZEY "*Two for One*"* DISTILLATION SYSTEM

This Henszey unit is a compact and extremely efficient evaporator that produces adequate supplies of fresh water of highest quality and purity . . . an important item in certain manufacturing methods, food processing, chemical formulations, power production and human consumption.

Henszey Distillation Systems can be built in any desired capacity from 3,000 to 50,000 pounds per hour in one single, compact unit. They can be furnished with or without integral boilers. They can be fabricated from steel, stainless steel, monel, copper or combinations of the above to meet your purpose. Get to know more about these remarkable units—they may be the answer to an abundant low cost supply of pure water required in your post war plans . . . or they may be the answer to an immediate war production problem now.

HENSZEY CO. Dept. D-9 Watertown, Wis.



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A remarkable achievement of design and performance!

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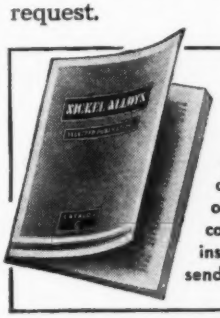
to SPEED 'EM UP!

The ingenuity and experience of automotive engineers made possible the design of military vehicles, engineered for quality and quantity production in numbers that amazed the world. This kind of engineering-thinking pioneered the application of Nickel alloyed materials and foreshadows new achievements in the realm of peacetime automotive transportation.

In steering knuckles or differentials, in forged gears or cast blocks, a little Nickel goes a long way to provide essential dependability. It improves strength/weight ratios, increases wear and corrosion resistance, imparts toughness, and assures uniform properties of the metals with which it is combined.

For years the technical staffs of International Nickel have been privileged to cooperate with automotive engineers and production men. Counsel, and printed data about the selection, fabrication and heat treatment of ferrous and non-ferrous metals is available upon request.



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This UNIVERSAL packing—of long, pliable, anti-friction metallic alloy strands—assures low cost, long life packing protection and easy application on any rod in good condition. "AMBEST"—available for all pressures and temperatures up to 550° F. — is recommended for pumps, compressors, engines, throttles and valve stems. All needs are supplied by one packing when you use "AMBEST."

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FOR FAST REMOVAL OF HARD, THICK TUBE DEPOSITS

The E. P. Series Air Motor has the extra power needed for fast removal of hard, heavy deposits even in large diameter tubes. Where hard spots stall ordinary motors, the E. P. has the extra torque to cut through. This feature saves time, labor and money in tube cleaning.

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Thomas C. Wilson, Inc. maintains a large engineering staff for consultation in solving difficult tube-cleaning problems. A bulletin describing the complete Wilson line will be sent on request.

MODERN TUBE CLEANERS FOR THE PROBLEMS OF TODAY.

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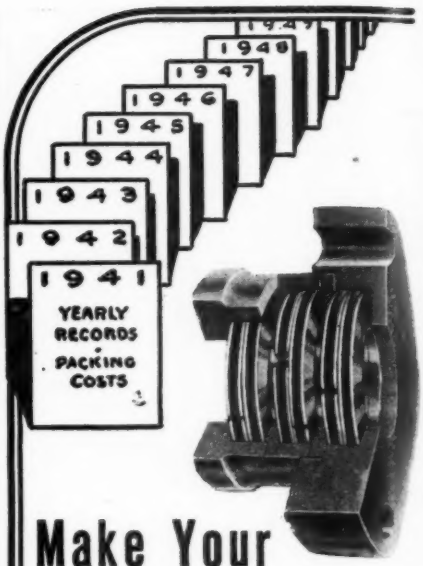

Make Your Next Packing Job *L-A-S-T!*

During these days of increased production, it is especially annoying and costly to experience shutdowns due to packing trouble.

There is a solution. Install France "Full-floating" Metal Packing in your engines, pumps and compressors. The result is increased efficiency. And each job lasts for years without maintenance expense. Saves money, too, in the long run.

Installation is a simple procedure. See that the rings are installed as lettered to correspond with similar letters on the case. As simple as A-B-C.

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Sold on approval
Satisfaction Guaranteed

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Accurate

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A fraction turn of the handwheel—and you can control *exactly* the pressure of steam passing through this very compact K & M Reducing Valve. Model 481 is widely used for difficult reduction service in industrial processes—and as a primary valve in double reduction installations. Self-contained . . . made in bronze . . . available in valve sizes of ½" to 2"—with 5⅜" the maximum overall measurement, face to face! Yet it accurately controls inlet pressures up to 250 lbs. . . . maintaining constant reduced pressures of 2 lbs. to 80% of the inlet. If you have a tough pressure reduction problem, perhaps K & M #481 is the answer. Our Engineering Department invites your inquiries.

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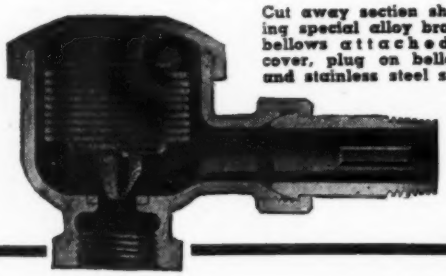
Awarded our employees for outstanding production achievement.

The CRYER Thermostatic RADIATOR TRAP



Cut away section showing special alloy bronze bellows attached to cover, plug on bellows and stainless steel seat.

A DEPENDABLE "GO" for water and air AND A SURE "STOP" FOR STEAM

Simple, efficient and continuous, trouble-free, operation over long periods of service can be definitely depended on. The CRYER will function uniformly without attention, waste or noise on any two pipe low pressure steam, vapor or vacuum system. Water, air and gases are permitted to pass from radiator to return line while steam is prevented from doing so.

Designed for a maximum pressure of 30 lbs. the CRYER conforms in dimensions to the standards adopted by the Heating & Piping Contractors' National Association. Made in ½" and ¾" sizes; ratings 300 and 400 ft. radiation. Complete details available on request.

***Also:* CRYER INVERTED BUCKET Steam Traps**

in capacities from 500 to 38,000 lbs.; all sizes and repair parts for the J-M Ball Steam Trap.

CRYER TRAP AND VALVE CO., INC.

Manufacturers of steam specialties for more than 40 years.

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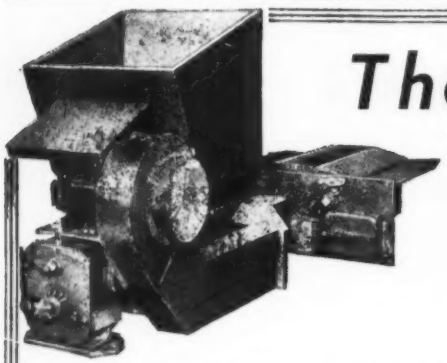

They Lessen INDUSTRY'S COAL BILL

FOR more than a quarter century "FREDERICK" STOKERS have been helping industrial concerns keep their coal bills at minimum. . . . But wartime need for all-out saving of fuel has added extra emphasis to the high combustion efficiency of these scientifically designed "feeder-burners."

Coal saving with the "FREDERICK" STOKER isn't an accident or good luck. We really *"planned* it that way." The fuel-saving qualities of the "FREDERICK" STOKER were gained by a proper coordination of engineering knowledge and experience with an understanding of industry's needs.

How we designed and constructed a stoker that enables you to get maximum heat out of every pound of coal is an interesting story. And it points the way to real cash savings as well as burner efficiency.

Write for a copy of FREDERICK STOKER CATALOG and "read all about it" as newsboys say.

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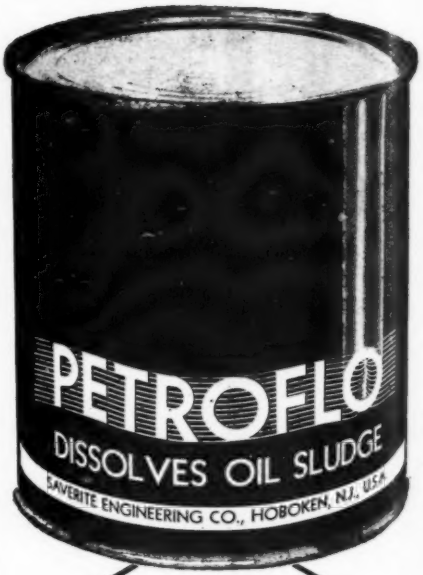

Cleans FUEL SYSTEM

Improves ATOMIZATION

All grades of fuel oil contain carbon ends and impurities. Minute clusters of these combine and settle to the bottom of the tank as sludge. This sludge builds up until it reaches the feeder pipe leading to the burner, clogging the system, carbonizing the burner tip, decreasing efficiency and, sometimes, causing shutdowns and expensive repairs.

Sludge removal by manual or mechanical methods is costly and time-consuming, especially in underground tanks. By adding 1 lb. Petroflo to each 1000 gals. (23 bbls.) while the fuel is pumped into the tank, sludge-forming carbon ends and impurities are maintained in suspension, assuring a steady, free flow of oil, which results in better atomization, and produces a soft, even, efficient flame.

Petroflo also dissolves sludge already in the tanks and fuel system, and keeps them clean. The cost of Petroflo is insignificant, considering the many benefits it offers.

Petroflo is stocked at convenient shipping points. Send us a sample order.

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WE ELIMINATED THE BARRIERS TO LOW-COST PUMPING!

BACKWATERS—eddies . . . sudden velocity changes . . . all these barriers to pump-efficiency have been eliminated in Gardner-Denver Centrifugal pumps.

For by rigidly controlling foundry practices . . . by assuring a minimum of obstruction in the line of flow and properly proportioning water passages, Gardner-Denver engineers have designed a pump that delivers an even, uniform flow of water.

Every proved mechanical and hydraulic feature that contributes to efficient low-cost pumping has been embodied in Gardner-Denver Centrifugals. Impellers and casings are cast to a special Gardner-Denver formula that assures the maximum in long-life and trouble-free service.

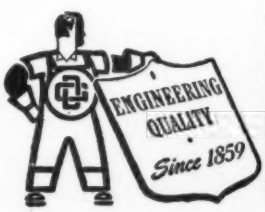
For complete details and specifications on Gardner-Denver Centrifugals write Gardner-Denver Company, Quincy, Illinois.

Horizontally Split-Case, Double-Suction Centrifugal for large capacities and heads up to 350 feet.

Close-Coupled Centrifugal can be installed in any position on floor, wall or ceiling. Capacities from 30 to 1,200 gallons per minute.

Side-Suction Centrifugal for general utility service. Capacities from 5 to 1,600 gallons per minute.

Type BA Side-Suction Centrifugal for heavy duty service. Will handle fluids containing solids or stringy material.



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YARWAY INVOLUTE SPRAY NOZZLES

Unique Yarway Involute design.

No internal parts or vanes to clog or erode.

Unobstructed flow gives minimum loss of head.

Finely divided spray cone provides rapid cooling.

Renewable orifices adapt nozzles for any service.

Installations total more than 5 million gallons per minute in water cooling and air conditioning service.

Made in both cast and bar-stock types. All sizes from 1/4 in. to 2 1/2 in. Write for Catalog N-616.

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100 Mermaid Ave., Philadelphia 18, Pa.

How to put STEAM PRODUCTION on a Post-War Basis

Now

After V-Day plant managers are not going to be patient with steam boiler equipment that is only 60% efficient. And 60% is the maximum obtainable from most boilers now in use. That rating, however, applied *when they were designed*—some fifteen or more years ago. In the years of service since, their efficiency has probably dropped still lower.

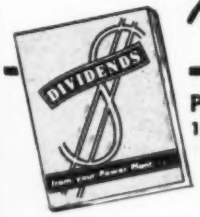
Your steam plant can be *80% efficient*—now.

The new Preferred Unit Steam Generator makes such an increase possible.

For it is a specially engineered, compact, portable steam generating plant that gives you modern boiler, oil burner, induced-draft fan, wiring, controls, all completely coordinated, ready to start producing steam anywhere, on making a few simple connections. No stack required, no special foundation. Sizes 20 to 500 HP.

Exacting wartime needs produced this Preferred Unit. Heavy steam-production demands proved its reliability. Private industry can profit by it. Let us send you full information in new Bulletin No. 1000. We'll include, also, a timely 36-page booklet on power plant economics, *Dividends from Your Power Plant* purely a service publication, not a word of advertising.

Mail coupon today



PREFERRED UTILITIES MANUFACTURING CORPORATION
1860 Broadway, New York 23, N. Y.

Please send, without obligation the bulletins checked.

☐ UNIT STEAM GENERATOR
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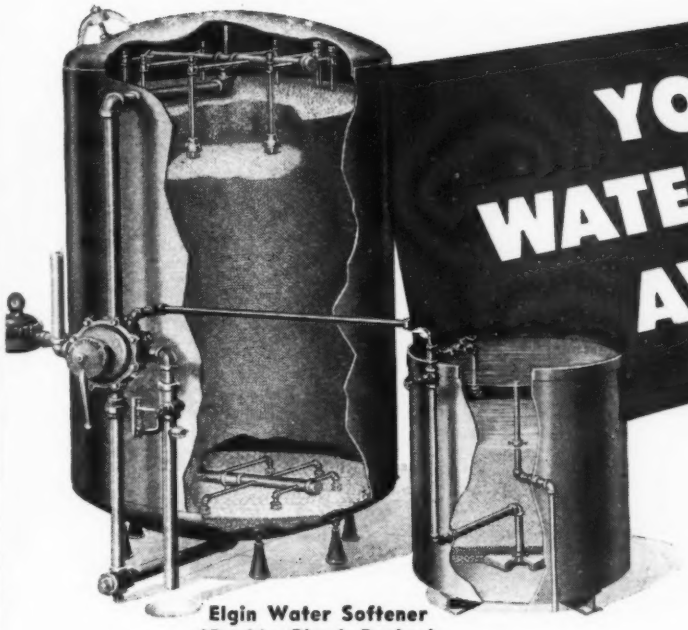
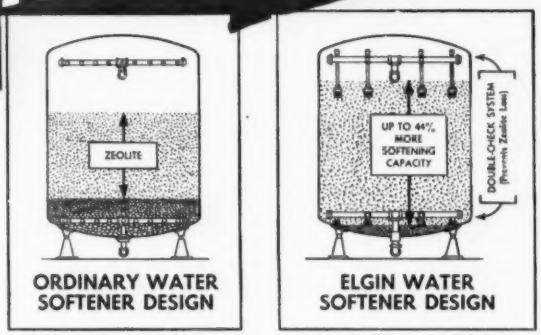
YOUR POSTWAR WATER SOFTENER IS AVAILABLE NOW



Elgin Water Softener
(Double Check Design)



The New Elgin Water Softener

- **GIVES UP TO 44% MORE SOFT WATER**
- **PREVENTS LOSS OF ZEOLITE**
- **CUTS SALT CONSUMPTION**
- **ASSURES BETTER BACKWASHING**

WHEN it comes to zeolite water softener equipment you don't have to take the "wait-for-something-better-after-the-war" attitude. That something better is here—and is *available now.* It's the new "Double Check" design water softener. A long list of users fully confirm the fact that this water softener gives 44% more soft water than can be secured from any other unit of equal size.

One of the chief reasons for this increased capacity is diagramed above. The new "Double Check" manifold arrangement permits placing a far greater amount of water softening zeolite in the softener, as shown. More zeolite means more soft water output, for after all, it's the zeolite that softens water. This ingenious manifold also permits the zeolite to be washed cleaner and prevents packing and channeling of the bed. Brine reaches every portion of the zeolite, giving complete, efficient regeneration with lower salt consumption. All this is accomplished without the possibility of zeolite loss. Here truly is tomorrow's water softener today.

The whole story is told in our new bulletin 603. *Write for it today.*

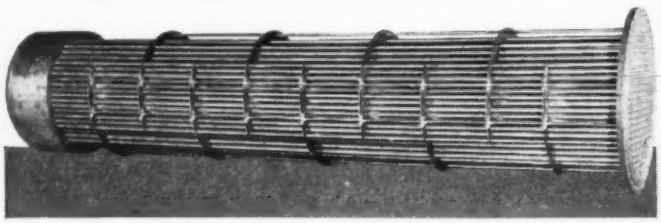
HERE'S HOW TO STEP UP THE CAPACITY OF YOUR PRESENT WATER SOFTENER

The "Double Check" manifold arrangement can be quickly installed in place of the ordinary manifold in your present water softener regardless of make. This, along with Elgin High-Capacity Zeolite, will give you greatly increased soft water output. The cost of such modernization is surprisingly low. Ask for facts.

ELGIN
ECONOMICAL WATER CONDITIONING

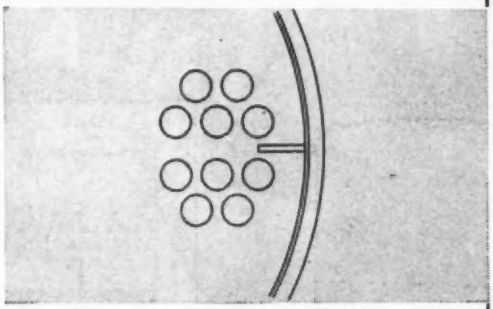
THE COMPLETE ELGIN LINE—Boiler Water Treating and Purifying Systems ● Feedwater Treatment ● Deconcentrators ● Heat Exchangers ● Water Softeners ● Filters and Purifiers ● Iron Removal Equipment ● Aerators ● Water Treating Chemicals ● Chemical Feeders ● Scale and Corrosion Inhibitors ● Sample Coolers ● Water Testing Equipment ● Zeolites

ELGIN SOFTENER CORPORATION, 130 North Grove Ave., Elgin, Illinois



PERFORMANCE and ECONOMY..

two important factors of PRACTICAL DESIGN



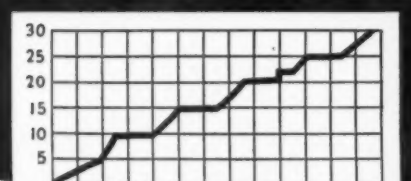
Cross Section view of Heat Exchanger showing Sealing Strips for blanking off potential by-passing where tube bundle does not entirely fill the shell.

A Downingtown designed unit must not only *work* but it must give trouble free, reliable performance over a reasonably long period, and it must be economical both in first cost and in maintenance expense. Here is an example of Downingtown efficient design, the purpose of which is to break up the flow of liquids outside the tube bundles. This result is attained by utilizing two separate sets of sealing strips on each side, in order to eliminate thoroughly any possibility of channeling of the shell side fluid.

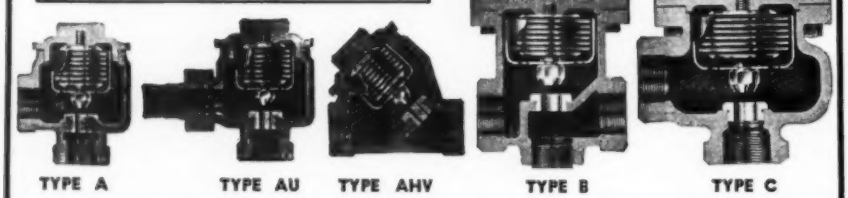
Our heat exchanger Knowledge is backed by over thirty years consecutive experience in the field of pressure vessel fabrication. Repeat orders in Heat Exchanger Equipment were over 70 per cent of Downingtown's 1942-43 business.

DOWNINGTOWN IRON WORKS
DOWNINGTOWN, PA.
HEAT EXCHANGERS

PLANT TESTS SHOW NICHOLSON TRAPS *Raise* PRODUCTION



Nicholson Traps Increase Production of Heated Units as Much as 30%



TYPE A TYPE AU TYPE AHV TYPE B TYPE C

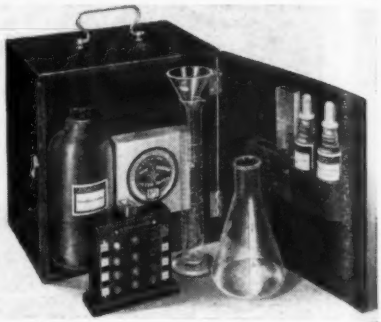
Faster Heat Transfer in all Steam Units Assured by QUICK, POSITIVE ACTION

The Nicholson Industrial Steam Trap is sturdily designed for high pressures and severe service, utilizing a heavy-duty bellows with brazed end plates and internal guide rod and tube. Enormous water and air discharging capacity, and positive intermittent valve action—not to be compared with light weight, low pressure radiator traps.

Two to six times greater valve area and capacity than average traps. No Air Binding. No Freeze-Ups. No Adjustment. No Dribbling. No Water-Logged Units. Hardened Stainless Steel Valves and Seats. 5 types—sizes ¼" to 2"—pressures vacuum to 225 lb. Bulletin 843.

W. H. NICHOLSON & CO. 125 OREGON STREET WILKES - BARRE, PA.

TAYLOR- *Standard of Accuracy*



Announcing THE *New* TAYLOR POLY PHOSPHATE COMPARATOR

The increasing use of low concentrations of poly (glassy) phosphates, such as meta, pyro, septa, etc., (threshold treatment) in water conditioning to prevent feed line deposition, to stabilize municipal water supplies and to reduce corrosion, make it imperative that a rapid, simple and accurate method of analysis be available.

The new Taylor Poly Phosphate Comparator is ideal for this purpose. It consists of a block with 8 standards, 0, 0.5, 1, 2, 4, 6, 8 and 10, 2 cells, funnel, filter paper, graduate, flask and reagents, in a wooden carrying case, $8\frac{3}{4}$ x $6\frac{1}{4}$ x 9 in.

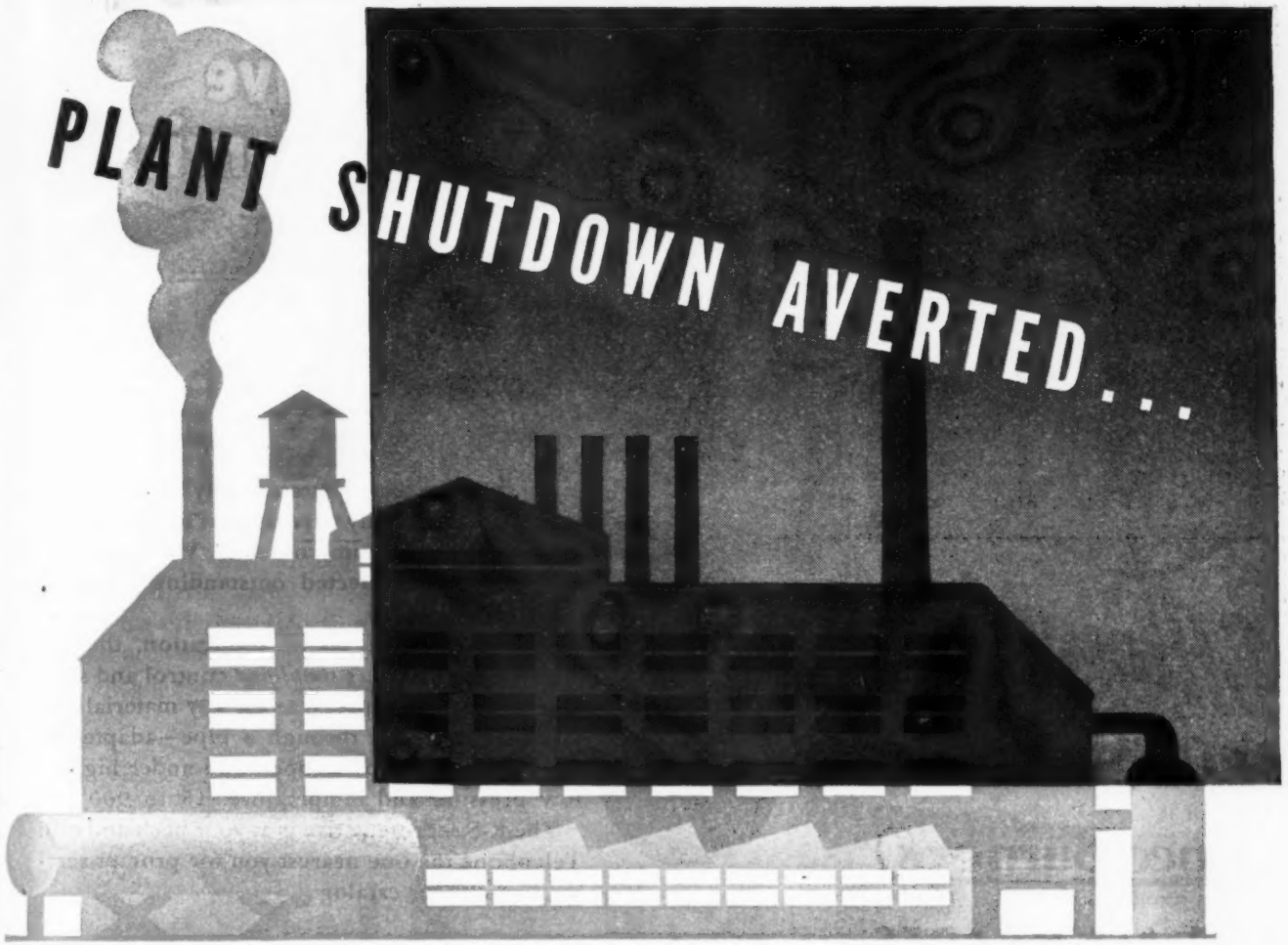
Previous methods required several hours to convert the glassy phosphates to the ortho form. By boiling with Taylor molybdate reagent, conversion takes place in 15 minutes. Stannous chloride is added and the blue color is compared with the standards. This gives the total phosphate content. A determination on the cold sample gives the ortho present in the sample. The difference is the poly phosphate. Since there are so many poly phosphates and since, in the determination, all of them are converted to the ortho form, the standards are made to represent ppm of phosphate as PO_4. Otherwise separate comparators would be required for each poly phosphate. If desired to convert to poly phosphate, multiply by the proper factor, such as 1.074 for the meta.

Price, complete. . . . $19.00 F.O.B. Baltimore

All Taylor Liquid Color Standards Carry AN UNLIMITED GUARANTEE AGAINST FADING.

See your dealer or Write for Free Booklet: "Modern pH and Chlorine Control"

W. A. TAYLOR AND CO.
YORK & ROGERS FORGE RDS. - BALTO 4, MD.



. . . during CHANGEOVER

Recurrent tube failures in 4 twenty-year-old straight tube boilers were giving a large eastern chemical plant plenty of trouble. At least one boiler was always off the line for tube replacements, making it extremely difficult to carry the load with the remaining boilers. Plant management decided to replace the four old boilers with two modern units, but this decision introduced another problem; dismantling two boilers to install the first new unit would throw the entire load on the remaining two boilers, and the new boiler would have to carry the load during the final stages of installation. The operational hazards of making these changes were obvious. *How could plant shutdown be avoided during the changeover?*

W. H. & L. D. BETZ was consulted and a chemical engineer was dispatched to the plant where he "lived with the job" for two weeks. As a result of his studies and recommendations tube failures were stopped within ten days. Two old boilers carried the entire load without a single tube loss while the first new boiler was installed, and the new boiler carried the load during the installation of the second unit. *The plant has now operated continuously for several years without a single tube failure.*

The solution of these problems involved correct operation of the lime-soda softener, the application of proper internal treatment, and training of plant personnel in the efficient control of boiler feed water conditioning. It illustrates how the facilities of this nationwide organization of chemical engineers are employed to quickly and effectively solve problems relating to industrial water conditioning.

CHEMICAL ENGINEERS AND CONSULTANTS ON ALL WATER PROBLEMS

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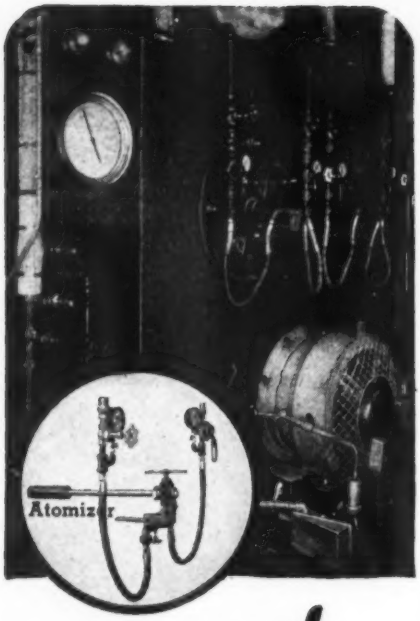


Efficient combustion with Enco Burners

FOR ALL GRADES OF LIQUID FUEL

Enco Burner Units of Steam or Mechanical Atomizing Types are made in various sizes with capacities from 1 to 1000 gallons per hour.

Designed for operation either with or without air registers and for natural or forced draft.

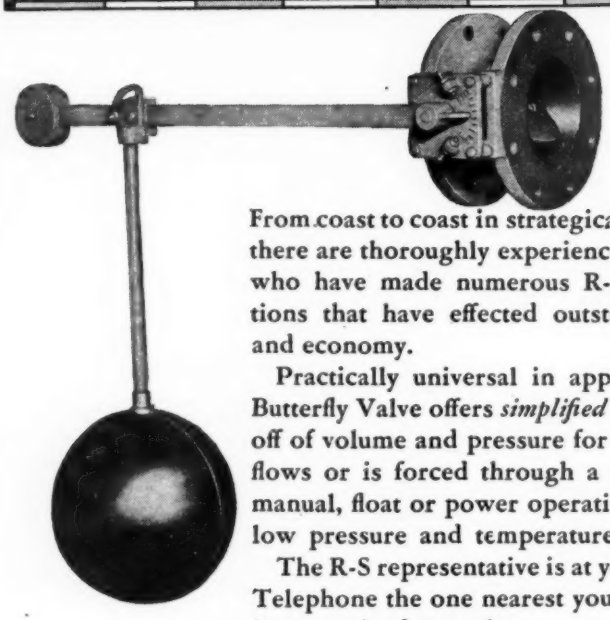
The Enco Interchangeable Atomizer is made for instant change of guns for operation by either steam or mechanical system or to cover a wide range of capacity.

Enco Atomizers are used with various types and makes of pulverized-coal and gas-burner units to provide a dual fuel unit for cold starting, or for full-load operation when coal or gas is not available, or use when oil is the more economical fuel.

We have made many installations during the past 25 years and are ready to cooperate with those looking for better operation and assurance against loss of steam output.

THE ENGINEER CO.
Enco 75 West St. New York 6, N. Y.

National R-S Valve Engineering Service



No. 579

No. 579. Direct action float valve with counterweight assembly.

From coast to coast in strategically located cities, there are thoroughly experienced R-S Engineers who have made numerous R-S Valve installations that have effected outstanding efficiency and economy.

Practically universal in application, the R-S Butterfly Valve offers *simplified* control and shut-off of volume and pressure for any material that flows or is forced through a pipe—adapted to manual, float or power operation under high or low pressure and temperature. 15 to 900 psi.

The R-S representative is at your beck and call. Telephone the one nearest you for prompt service or write for catalog.

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R-S *Streamlined* BUTTERFLY VALVES

GREAT "DUCTILE STRENGTH" AND DURABILITY IN THIS NEW LIGHT-DENSITY TYPE PRECISION MOLDED 85% MAGNESIA

• The Plant *Precision Molded* process* builds new "Ductile Strength" right into 85% magnesia heat insulating material—so that it will resist shock from shipping, accidental dropping and rough handling during installation—and so that it will really *hold* together even under severe vibrating service! • This new-type 85% magnesia likewise brings the advantages of unprecedented lightweight and lower thermal conductivity. It positively assures greater savings in fuel and heat, just as it assures faster, easier application and ultra-durability! Send now for complete descriptive data.

*U. S. Patents Nos. 2,131,374, 2,209,752, 2,209,753, 2,209,754.

PLANT RUBBER & ASBESTOS WORKS

COMPLETE RANGES OF SIZES and thicknesses in blocks and pipe coverings (up to and including 18-inch pipe size in sectional form. Larger sizes in segmental form).

MAIN OFFICE: SAN FRANCISCO

Sales Offices in Los Angeles, Wilmington, and Oakland, Calif.; distributors in principal cities. *Factories* in Emeryville, San Francisco, and Redwood City, Calif.

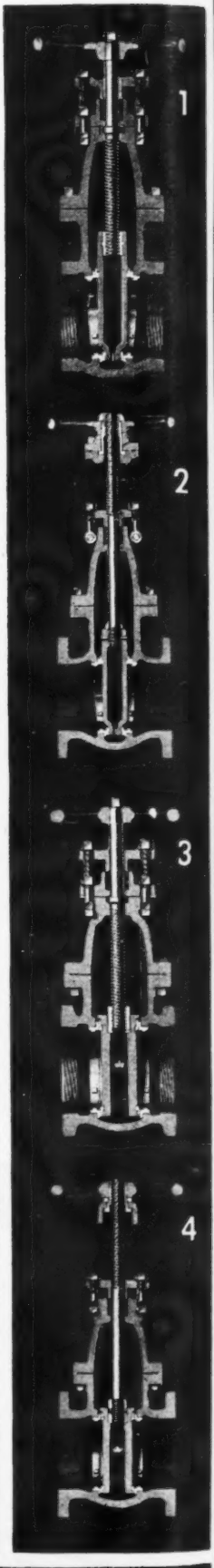
Manufacturers of Plant Insulating Materials and Mechanical Packings Since 1920

Army-Navy "E" Awarded to FACTORY No. 3 Emeryville, Calif.

Here is a simple chart for GATE VALVE SELECTION

Gate valves should be used where unrestricted flow is important. They should be used on lines where they will either be wide open or fully closed. They are not suitable for throttling or flow regulation.

TYPE	CHARACTERISTICS
WEDGE GATE	Can be installed in any position. Generally considered best for steam service. Have no loose internal parts to rattle or vibrate.
DOUBLE DISC	Generally considered best for liquid and gas service. Should not be installed in an inverted position.
OUTSIDE SCREW AND YOKE	Best for high temperature service. Advisable for corrosive service as stem threads are outside of valve chamber. Stem threads can be cleaned and lubricated. Position of stem indicates position of disc. Must have sufficient headroom for travel of stem when valve is open.
NON-RISING STEM	Necessary where headroom is limited. Undesirable on high temperature or corrosive service as stem threads are in contact with fluid or gas. There is no outward indication as to position of disc.



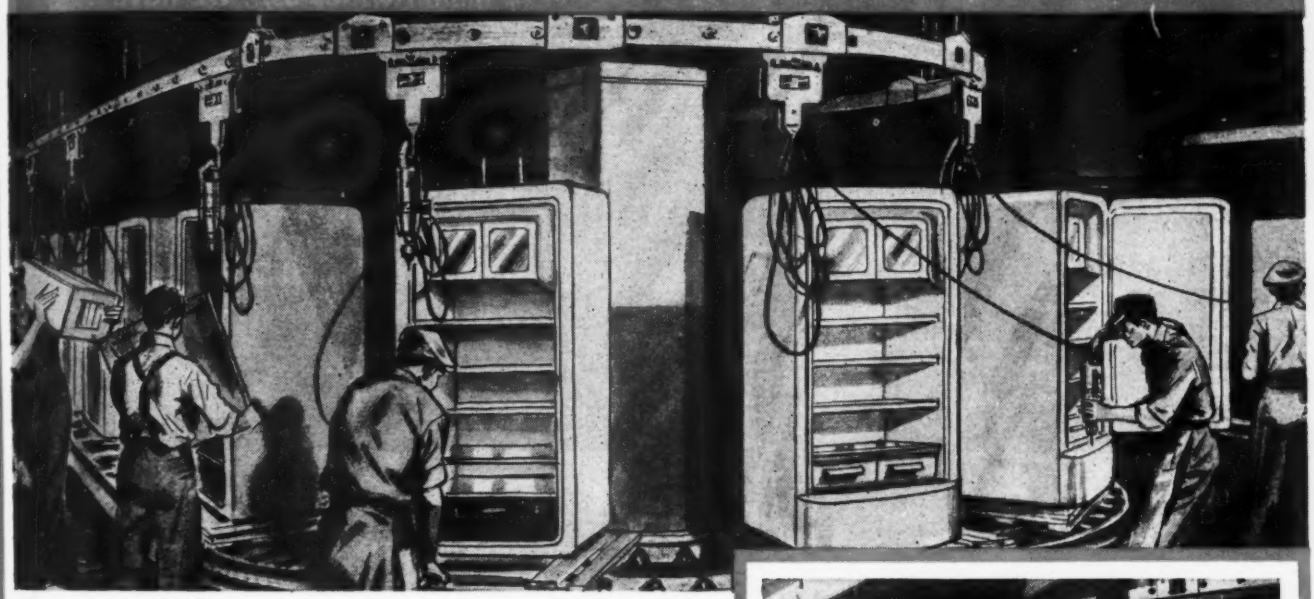
1. Kennedy Standard Wedge Gate Valve with Non-rising Stem
2. Kennedy Standard Wedge Gate Valve with Outside Screw and Yoke
3. Kennedy Standard Double Disc Gate Valve with Non-rising Stem
4. Kennedy Standard Double Disc Gate Valve with Outside Screw and Yoke

The large Kennedy valve line includes iron-body and bronze gate, globe, angle and check valves for steam pressures up to 300 lb. and water pressures up to 600 lb. Catalog 63 describing all the Kennedy valve types in detail, together with Kennedy Pipe Fittings and Fire Hydrants, will be sent on request.

KENNEDY

VALVES • PIPE FITTINGS • FIRE HYDRANTS
THE KENNEDY VALVE MFG. CO. • ELMIRA, N.Y.

...BACK TO PEACETIME PRODUCTS



BullDog Will Speed Reconversion

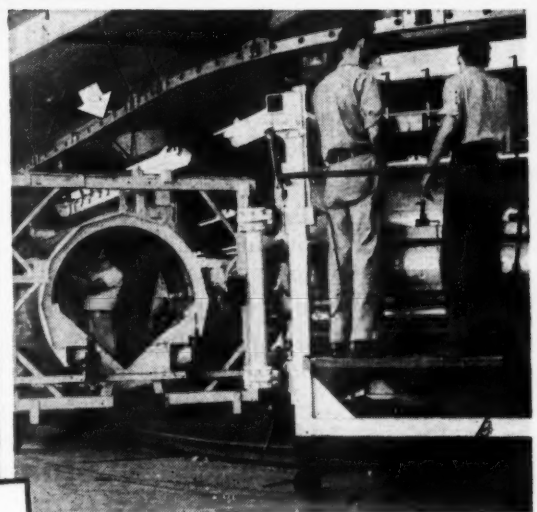
There's a big peacetime job ahead for portable tools, cranes, hoists and other "moving loads" . . . as big a job as they have had in the last three years of war production.

And, when reconversion starts, plants equipped with BullDog Industrial Trol-E-Duct will find their mobile power problems solved.

Only Industrial Trol-E-Duct has fully met the need for safe, convenient, flexible power that travels along with the tool or other moving load. Like other BullDog bus duct systems, it can be quickly moved to any location — readily adapted to any shop set-up.

We invite you to call on expert BullDog engineers for help in your reconversion planning — and we'll send descriptive folders promptly on request.

Help Invasion Rail—Buy More War Bonds



No more open trolley wires — no more long, dangling cords — with BullDog Industrial Trol-E-Duct. Safety goes up, production losses go down, and big savings are effected in wiring and fixed equipment. Not only as a feeder for portable tools on moving assembly lines, but also as a feeder for cranes and hoists—Industrial Trol-E-Duct is an indispensable helper in all kinds of plants.

BULLDOG
ELECTRIC PRODUCTS CO.

BOX 177, R. PK. ANNEX
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ALSO MANUFACTURERS OF
VACU-BREAK SAFETY SWITCHES • SWITCHBOARDS
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• CIRCUIT MASTER BREAKERS
• BUSDUCT SYSTEMS

MAKE ONE BEARING OUTLIVE TWO!

One plant that regularly had two or three bearing failures a month writes us, "We have had only one bearing failure in five years since using LUBRIPLATE"... another writes, "Pulled our ball bearing temperatures down from 170° to 130°F"... still another, "If LUBRIPLATE cost $1.50 a pound we could still afford to use it."

BALL BEARING LUBRIPLATE

Over a period of years this outstanding grease type lubricant has reflected superior performance on the general run of ball and roller bearings operating under normal conditions at speeds up to 5,000 R. P. M. and temperatures from zero to 300 degrees F.

Long time users of BALL BEARING LUBRIPLATE everywhere attest to its superiority in providing cool and quiet operation – protection against corrosion, and of major importance, substantial reduction in bearing replacement costs.

Write today for your copy of Bulletin No. 1-43 containing valuable data on the lubrication and care of anti-friction bearings.

7 FACTS ABOUT LUBRIPLATE

1. *LUBRIPLATE produces an ultra-smooth, wear-resisting bearing surface.* 2. *LUBRIPLATE reduces friction, thus lowering maintenance and power costs.* 3. *LUBRIPLATE resists rust, corrosion and pitting.* 4. *Most LUBRIPLATE products are white. LUBRIPLATE assures clean lubrication.* 5. *LUBRIPLATE outlasts ordinary lubricants many times.* 6. *LUBRIPLATE is economical—a little goes a long way.* 7. *LUBRIPLATE is available in fluid and grease types for every need.*

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FISKE BROTHERS REFINING COMPANY
Newark, N. J. **SINCE 1870** Toledo, Ohio
DEALERS FROM COAST TO COAST

LUBRIPLATE

"Its the Film"

THE MODERN LUBRICANT *that Arrests Progressive wear*

ANOTHER HEAVY-DUTY JOB FOR THE SULLIVAN WG-9 AIR COMPRESSOR

Making furnace plates, ladles and similar long-life pieces of steel mill equipment is a heavy-duty job. At the John Mohr and Sons plant, where this type of work is done, every tool is pneumatically operated . . . and a heavy-duty, long-life Sullivan WG-9 furnishes the air power efficiently and economically.

This precision-built compressor is designed for continuous, 24-hour-a-day service in small plants or for specialized service in larger plants. Here are some of the 25 reasons why your next air compressor should be a Sullivan WG-9 "INDUSTRIAL-AIR" —

1. It is the ONLY single-stage, double-acting compressor with FULL FORCE-FEED LUBRICATION.
2. Perfect fit anti-friction main bearings and interchangeable crankpin bearing NEVER REQUIRE ADJUSTMENT.
3. Cylinder liners and crosshead guides are REPLACEABLE ON THE JOB, making it possible to have a "new" compressor after years of satisfactory service.
4. Valve cage-ports are completely jacketed for high cooling efficiency.
5. The WG-9 is equipped with exclusive patented Sullivan "Dual-Cushion" valves, proved by service and produced entirely by Sullivan.
6. The WG-9 has greater capacity per foot of floor space.

SULLIVAN WG-9 AIR COMPRESSOR INSTALLED AT

JOHN MOHR & SONS

MAKERS OF

HEAVY-DUTY STEEL MILL EQUIPMENT

The "Industrial-Air" is built in 11 sizes, with displacements from 153 to 822 C.F.M. and pressures from 30 to 150 lbs. Bulletin A-43 contains complete details. Write to Sullivan Machinery Company, Michigan City, Ind. or any Branch office. In Canada: Sullivan Machinery Co. Ltd, Dundas, Ontario.

PRODUCTS

STATIONARY AND PORTABLE AIR COMPRESSORS FROM ¼ TO 3000 H.P., PNEUMATIC CASTING GRIPS, FOUNDATION BREAKERS, PORTABLE HOISTS, AND ROCK DRILLS.

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AIR COMPRESSORS . . . *from ¼ to 3,000 h. p.*

Stars of Leadership

ARE HARD TO WIN...HARDER STILL TO KEEP!

● Top-ranking leaders know there's more to leadership than glory—there's big responsibility, too!

In Pipe Tools—for nearly half a century TOLEDO has maintained unbeatable quality and performance in their complete line... with unceasing Research.

These *better* Toledo products are backed by progressive-minded engineering, manufacturing and sales policies. Whatever your needs in Pipe Tools today...and tomorrow...specify TOLEDO! The Toledo Pipe Threading Machine Company, Toledo, Ohio. New York Office, No. 2 Rector Street Building.

TOLEDO

PRECISION PIPE TOOLS

3-WAY THREADER — lightest, smallest and easiest to operate of all 3-way tools! No. 30 threads ⅛" to ¾" pipe, weighs 4¾ lb. No. 31 threads ½" to 1" pipe, wt. 7 lb.

Open-Side PIPE VISE — practical, convenient, quality-built. Capacities for ⅛" to 4½" Pipe.

Black Sulphur Base THREAD CUTTING OIL —for smooth, sharp, accurate threads. Specify TOLEDO Cutting Oil in one-gallon sealed cans or 5-gallon sealed pails.

"MORE THAN 10% INCREASE IN GASOLINE MILEAGE!"*

Ring-Free removes carbon. Keeps pistons clean, rings free. Reduces power loss.

Ring-Free's high film strength and long cling make bearings last longer, even under overloads.

Ring-Free holds foreign particles in suspension... stops sludge formation, reduces port clogging.

You'll move more tons of material per gallon of fuel consumed if you use Macmillan Ring-Free Motor Oil. That is a simple statement of fact, and the reasons are very easy to explain.

It takes *power* to move material. It also takes power to *overcome internal engine friction.* The more internal friction is reduced, the more power you'll have for hauling material, or other productive work.

Ring-Free Motor Oil cuts friction-power-loss materially, because it *reduces friction fast.* It lubricates better because it removes carbon, has high film strength, long cling and thorough penetration.

*TESTED AND PROVED ON THE JOB

Operators everywhere find their engines run better and last longer when lubricated with Ring-Free. Power is increased, shut-downs and repairs are decreased. Operating and maintenance costs go down, production and profits go up.

You, too, will notice *immediate improvement* when you change to Ring-Free. Give it the hardest tests you can, on your toughest jobs. It will effectively answer many of your difficulties.

*"*For the past seven years I have been using Ring-Free Motor Oil in my fleet. I get from seventy to eighty thousand miles before changing motors or being forced to make any major repairs. I never have any sticky valves and but slight traces of carbon, and my gasoline mileage has increased more than ten per cent."*

Henry J. Schafer, Jr., Pres.
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MACMILLAN RING-FREE MOTOR OIL

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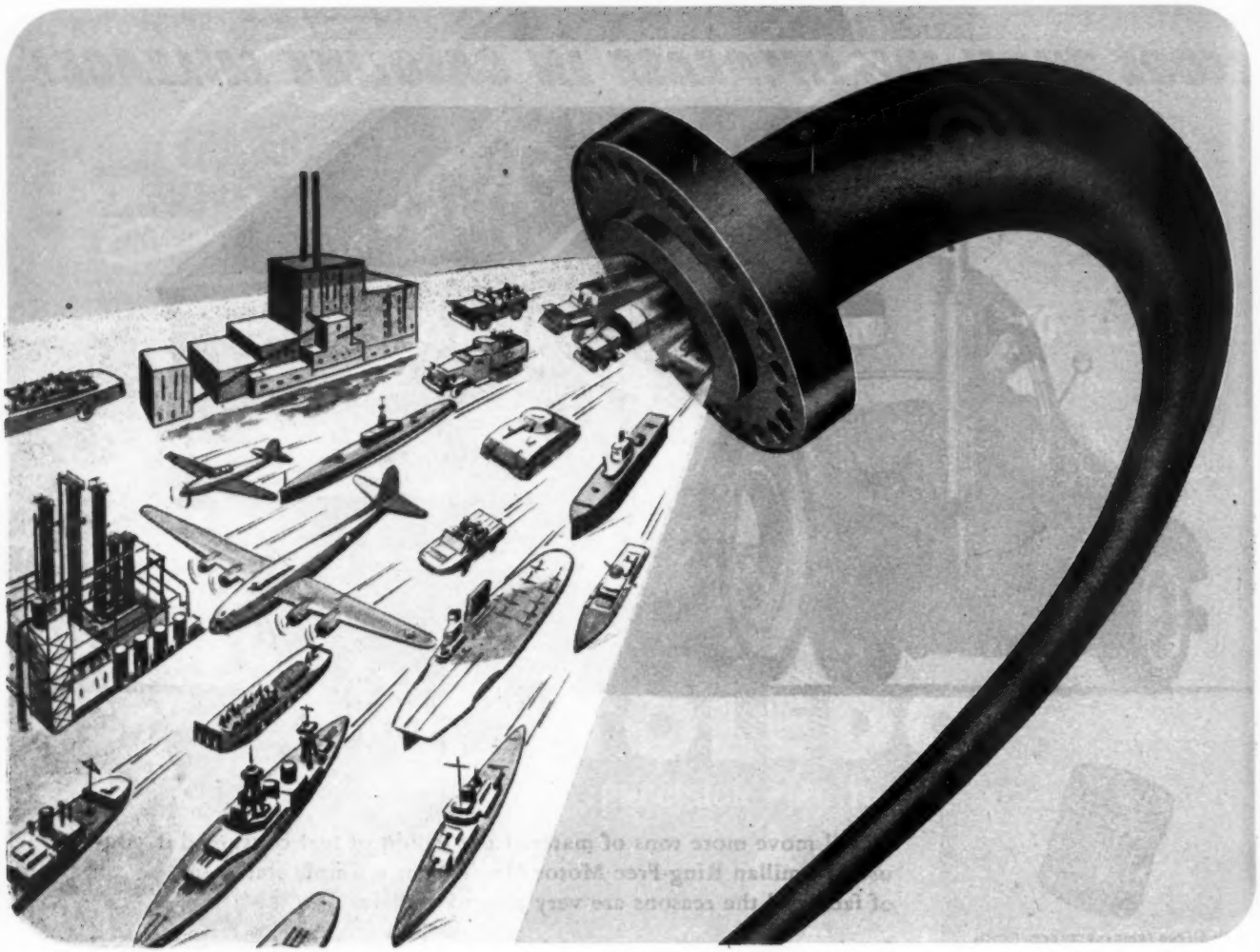


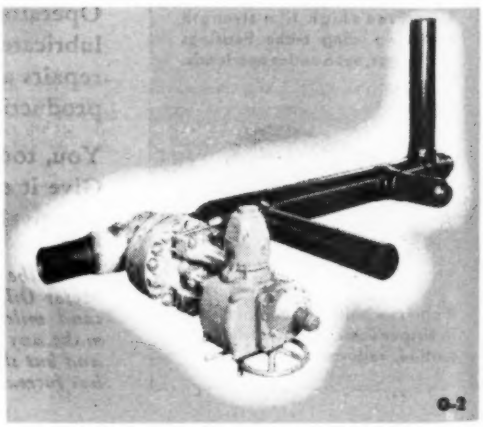
PRE-FABRICATED PIPING

Played an IMPORTANT PART in the Outstanding War Production Record of American Industry!

It is nearly impossible to find a war-important industry that does not make extensive use of piping for power, heating or industrial processing. Hence, the conversion of American industry to war demanded an enormous amount of piping—and required it fast.

Qualified pipe fabricators—by straining their organizations and equipment to the utmost in the production of pre-fabricated piping—were able to meet this unprecedented demand with a speed which played an important part in the promptness with which industry was able to take on the terrific war load. The advantages of pre-fabricated piping were never more conclusively demonstrated.

Pre-fabricated piping is delivered to the job in a series of subassemblies with the difficult operations performed in the fabricating plant. These subassemblies are commercially practical, heat treated and stress relieved when necessary, correctly aligned, thoroughly cleaned, shop tested and inspected before leaving the shop.



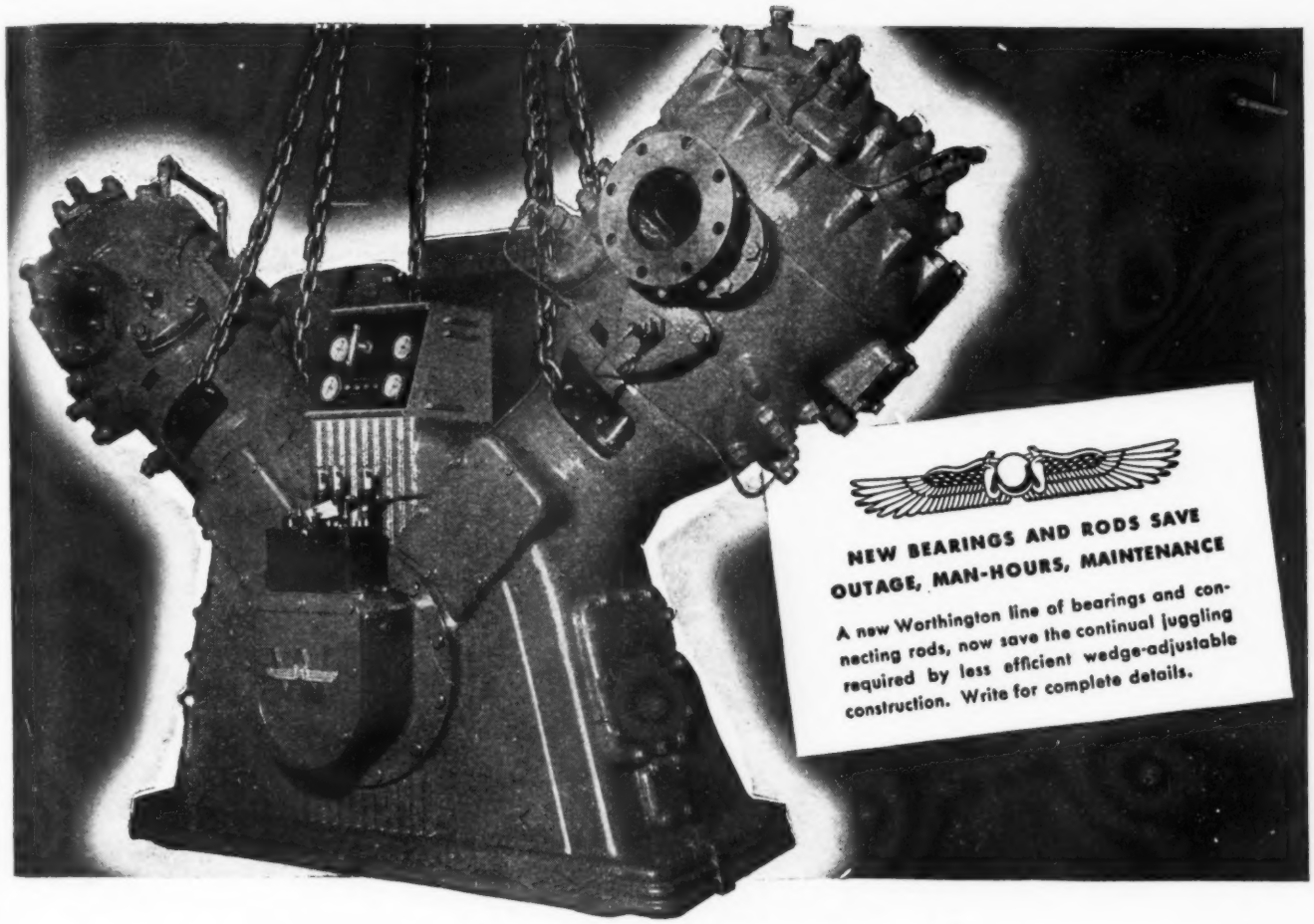
THE PIPE FABRICATION INSTITUTE

P.F.I. THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH, PA.

PUT IN A HUSKIE...FASTER


NEW BEARINGS AND RODS SAVE
OUTAGE, MAN-HOURS, MAINTENANCE
A new Worthington line of bearings and connecting rods, now save the continual juggling required by less efficient wedge-adjustable construction. Write for complete details.

New Worthington YC "packaged" unit meets 4 requirements of modern compressor design

No erecting engineer, no special foundations are required when you install this Huskie. It comes packaged for quick installation.

Two-fisted "Y" design gives you these four big advantages:

1. ***Higher Speeds.*** Vertical Y-frame for perfect balance and higher r.p.m. Rugged construction, for continuous high speed operation.

2. ***Ease of Installation.*** 75% less foundation space than horizontals of the same capacity. Quick, safe installation — even where subsoil is poor—without special clamps or engineering service.

3. ***Accessibility of parts.*** Quicker, easier periodic inspections. Large handy openings. Valves outside, for accessibility. Full-floating metallic packing easily reached.

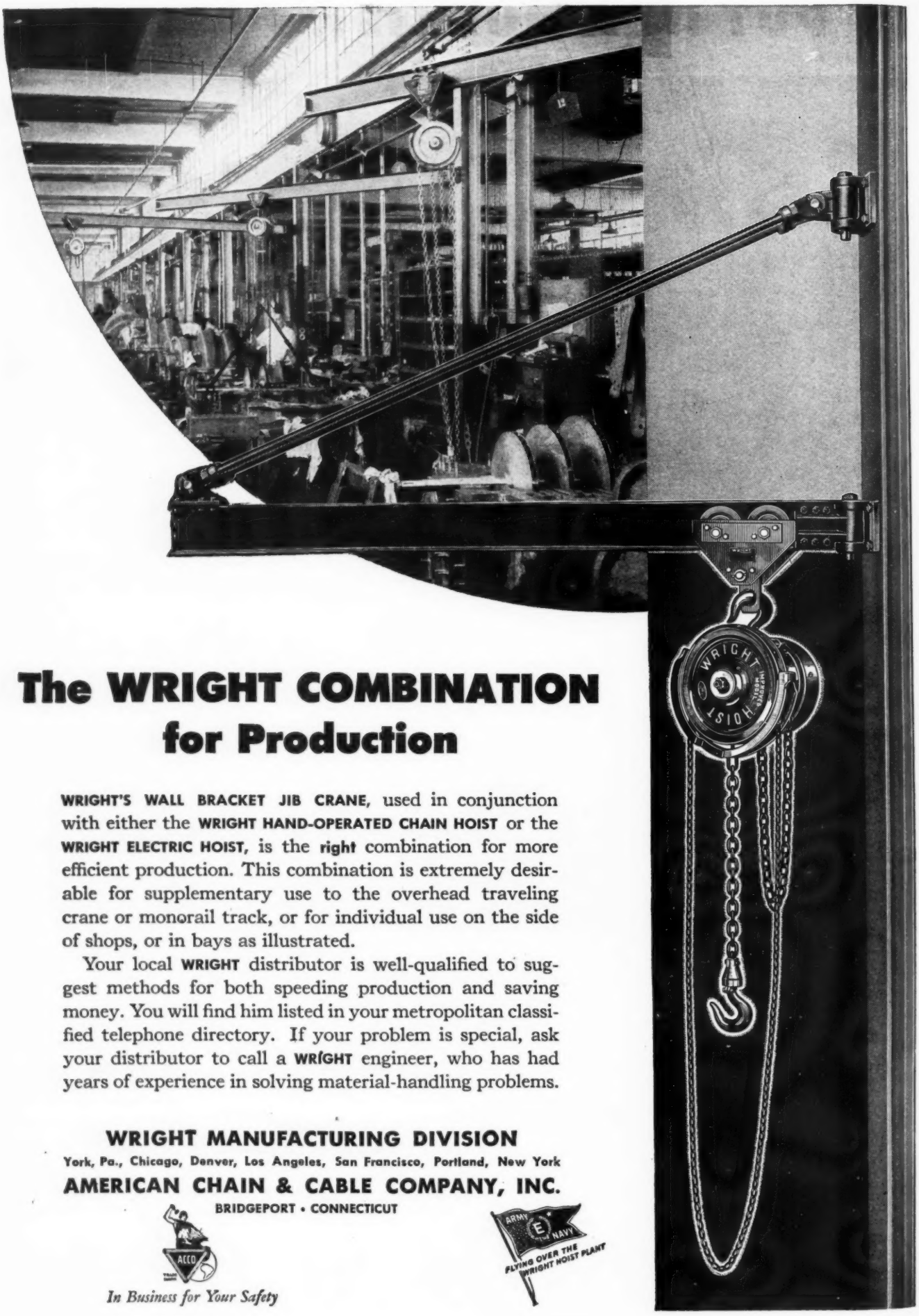
4. ***Adaptability to many drives.*** Flanged type, synchronous or induction motors, directly mounted on compressor shaft. Easily arranged for Multi-V-Drive or for coupled drive from explosion-proof motor or practically any type of rotative power.

Write for free Bulletin L-667-B1. *Worthington Pump and Machinery Corporation, Harrison, New Jersey.*

WORTHINGTON *BEHIND THE NAME* **WORTHINGTON**

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

Y-types	Horizontal	Vertical	Radial	Portable	Gas Engine Compressors



The WRIGHT COMBINATION for Production

WRIGHT'S WALL BRACKET JIB CRANE, used in conjunction with either the **WRIGHT HAND-OPERATED CHAIN HOIST** or the **WRIGHT ELECTRIC HOIST,** is the **right** combination for more efficient production. This combination is extremely desirable for supplementary use to the overhead traveling crane or monorail track, or for individual use on the side of shops, or in bays as illustrated.

Your local **WRIGHT** distributor is well-qualified to suggest methods for both speeding production and saving money. You will find him listed in your metropolitan classified telephone directory. If your problem is special, ask your distributor to call a **WRIGHT** engineer, who has had years of experience in solving material-handling problems.

WRIGHT MANUFACTURING DIVISION

York, Pa., Chicago, Denver, Los Angeles, San Francisco, Portland, New York

AMERICAN CHAIN & CABLE COMPANY, INC.

BRIDGEPORT • CONNECTICUT

ACCO

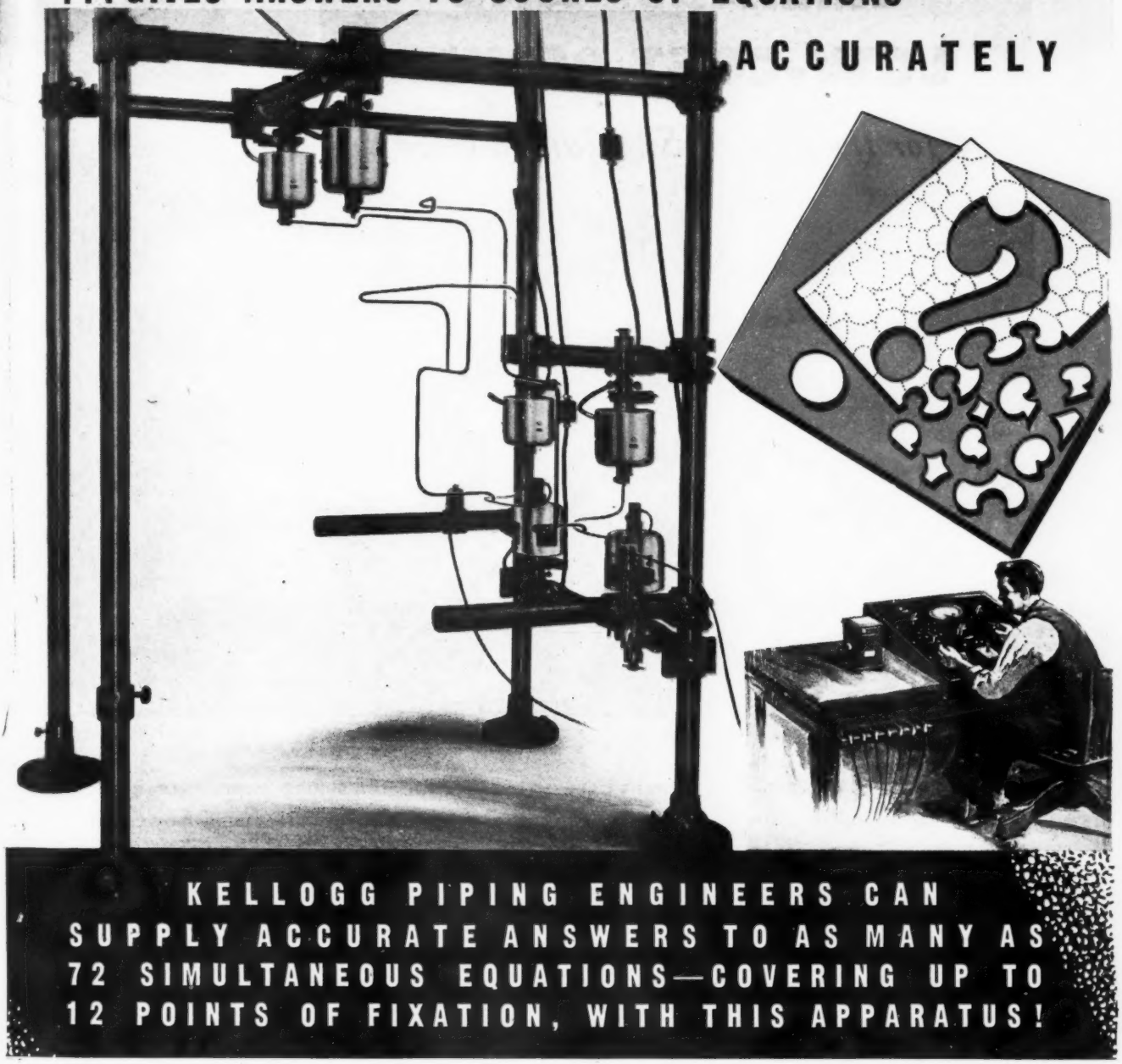
In Business for Your Safety

ARMY E NAVY

FLYING OVER THE WRIGHT HOIST PLANT

DETERMINING MOMENTS AND FORCES ELECTRICALLY

...GIVES ANSWERS TO SCORES OF EQUATIONS ACCURATELY



KELLOGG PIPING ENGINEERS CAN SUPPLY ACCURATE ANSWERS TO AS MANY AS 72 SIMULTANEOUS EQUATIONS—COVERING UP TO 12 POINTS OF FIXATION, WITH THIS APPARATUS!

The super-sensitive instruments which make this possible were designed and are used exclusively in the Kellogg Engineering Department for the sole benefit of Kellogg clients. By their use the most complicated design problems of high pressure, high temperature piping systems are solved accurately and quickly—an exact scientific analysis of the end reactions is arrived at.

There is no guess work, no possibility of error or delay in figuring, when these sensitive Kellogg instruments are used. They reduce figuring time, assure absolutely accurate results and thus save our clients time and money by giving them mechanically and scientifically correct piping systems for their individual needs as well as often substantially reducing the quantity of vital piping material

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Jersey City, N. J. • 225 Broadway, New York 7, N.Y.
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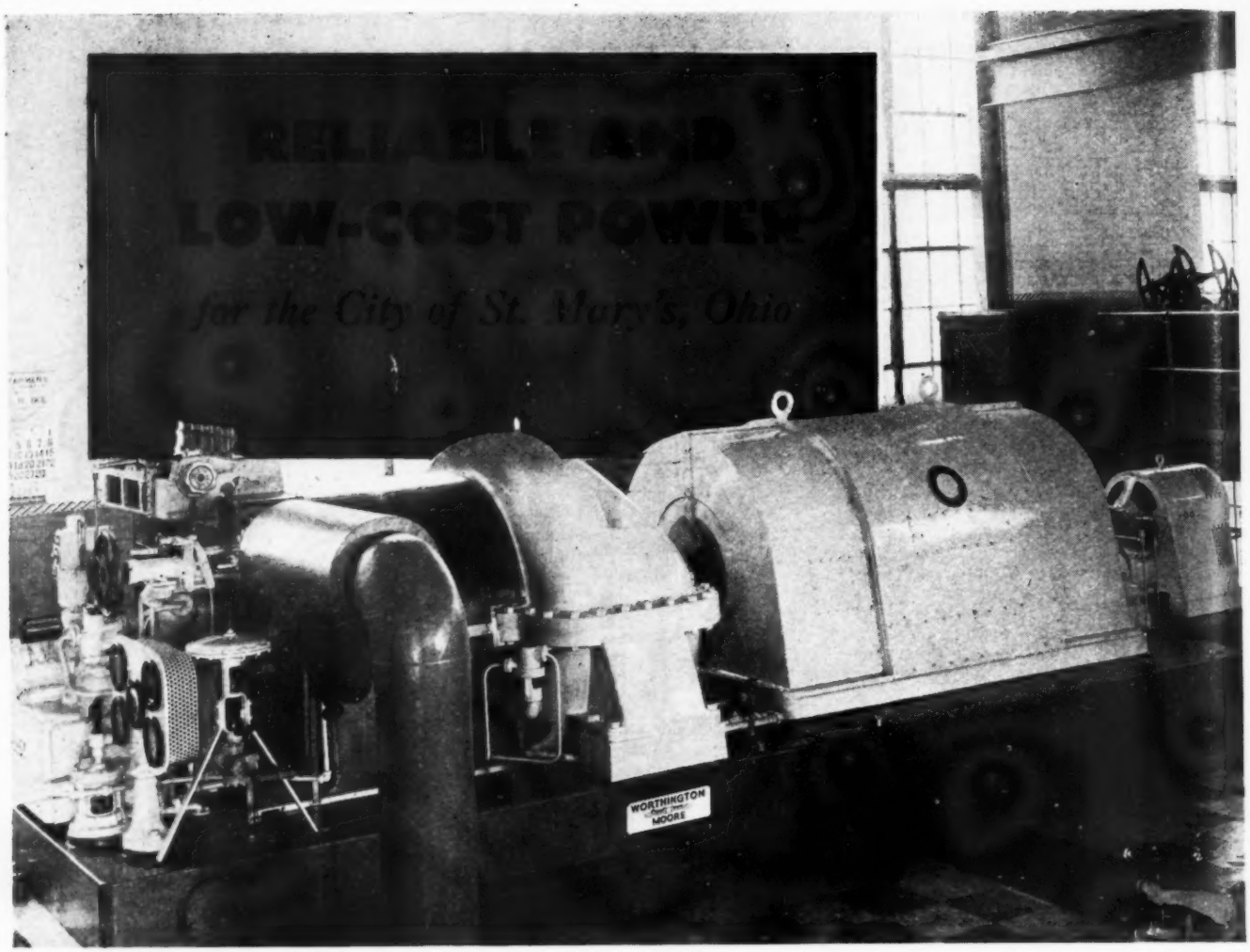
M KELLOGG W

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units • JUIK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.



Municipal Power Plants, especially those serving vital War industries, must have reliable and efficient turbo-generators. A representative Worthington-Moore installation is shown above.

This 2500 KW Worthington-Moore turbo-generator unit is installed in the Municipal Electric Light Plant in the City of St. Mary's, Ohio. The turbine operates on steam at 400# initial pressure, 750°F. total temperature and exhausts to 28" vacuum. Altho it is rated at 3125 KW maximum at Unity power factor, the unit has carried loads as high as 3400 KW.

Making both single-stage and multi-stage turbines and turbo-generator sets . . . backed by Worthington's long experience in building equipment for the steam power plant, Worthington-Moore engineers are ready to study your power requirements and estimate your savings with a Worthington-Moore unit. Write us. Worthington Pump and Machinery Corporation, Moore Steam Turbine Division, Wellsville, N. Y.

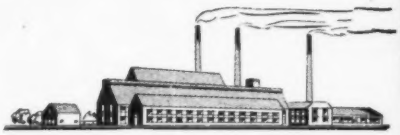
BEHIND THE NAME
WORTHINGTON
MOORE

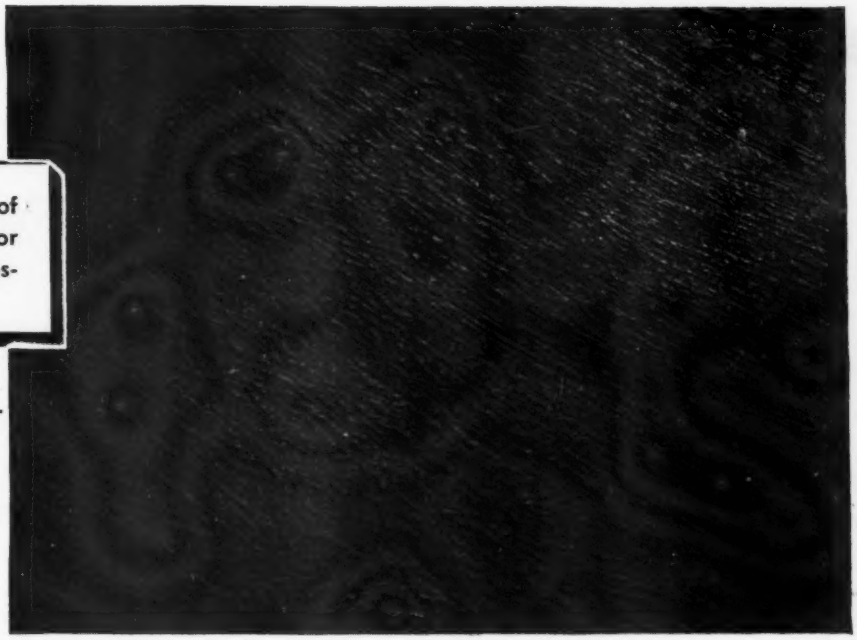
MR4-3

PRODUCTS OF WORTHINGTON

AIR CONDITIONING EQUIPMENT • REFRIGERATION AND ICE PLANT EQUIPMENT • AIR AND GAS COMPRESSORS • STEAM TURBINES • DIESEL ENGINES • GAS ENGINES • CONVERTIBLE GAS-DIESEL ENGINES • CENTRIFUGAL HIGH-PRESSURE BOILER FEED PUMPS • DIRECT-ACTING STEAM PUMPS POWER AND ROTARY PUMPS • TURBINE WELL, SUMP AND DRAINAGE PUMPS • STEAM CONDENSERS AND AUXILIARIES • VACUUM PUMPS • STEAM-JET EJECTORS • WATER PURIFICATION EQUIPMENT • PORTABLE COMPRESSORS AND AIR TOOLS — For street . . . trench . . . conduit service V-BELT DRIVES • LIQUID METERS

This APEXIOR coating on a plant boiler of a candy factory has been in service for 9 years without renewal. Operating pressure, 250 lbs.





HOW TO PREVENT WAR-STRAINED BOILERS FROM BOGGING DOWN

Under three-shift operation . . . a boiler may be called upon to evaporate three times as much as normally required. This means three years' work in one and because of severe overloads, probably more than three times as much wear.

In hundreds of industrial plants APEXIOR is one of the most important factors today in keeping boilers in service. It not only prevents serious corrosion — thus assuring uninterrupted operation and longer life — but also prevents tight bonding of water scale, extending the length of time between cleaning and making cleaning faster and easier.

Whether or not you have a high priority rating, uninterrupted boiler service justifies every possible safeguard and self-preservation justifies every protection of your boiler.

APEXIOR Prevents Corrosion for 2-3 Years

APEXIOR NUMBER 1 is brush-applied by hand or power coater. It fills in the pores and joints of all hot-wet surfaces, forming an impenetrable barrier against water. There is less adherent scale.

This tough, smooth coating is not affected by high temperatures or ratings, by chemical treatment of boiler water or by varying feedwater conditions. It does not retard heat transfer in operation.

APEXIOR
Easily Renewed

The life of the application varies with the service and wear. It will last 2 or 3 years, often much longer.

Save Materials — Man Power

Apexiorize your boilers. Keep the metal young. Avoid damage and wasted man power that cannot be measured in dollars.

Write for Bulletin 1290 containing facts on a paint that fortifies metal against the ravages of war schedules.

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- Portland General Electric Co.
- Hercules Powder Co.
- Gulf Shipbuilding Corp.
- The Pullman Company
- International Paper Co.
- Socony Paint Products Co.
- Sears, Roebuck & Co.
- The Stanley Works
- Combustion Engineering Co., Inc.
- American Viscose Corp.
- Curtiss Wright Corp.

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A Peacetime Plus ★ ★ ★ A Wartime Must

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STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

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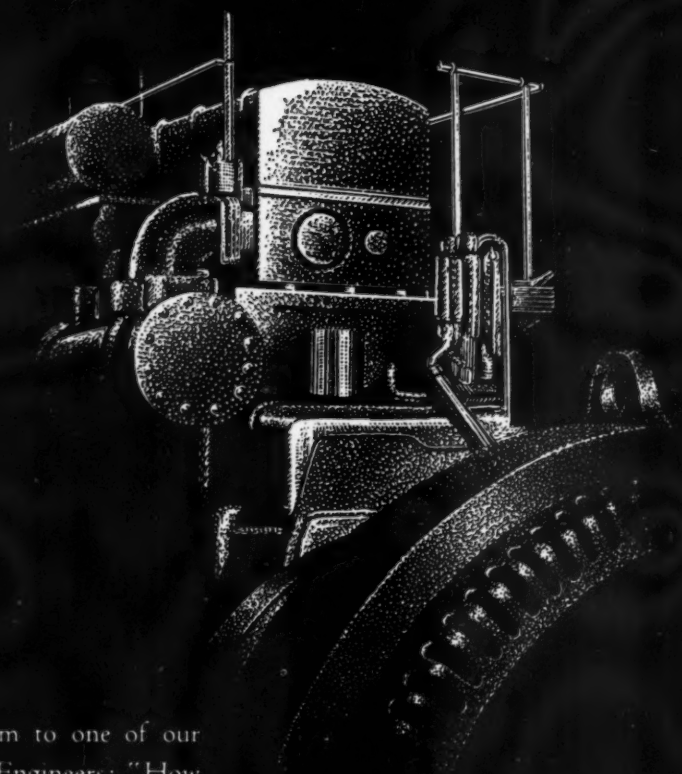
EXAMPLE OF *Service*:



A large company put this problem to one of our Cities Service Diesel Lubrication Engineers: "How can we reduce Diesel breakdowns that are seriously interfering with production?"... Our engineer studied the facts and recommended a special Cities Service Diesel lubricant. In 38 months since, Diesel efficiency has been steadily maintained, with engine overhauls reduced by the amazing figure of 30%.

More and more, it's service that counts...

and *Cities Service* means *good service*!

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HOW TO MAKE STEAM COSTS "STAY LICKED"

Fuel-Saving Starts With CONTROL

IT'S ONE THING to win skirmishes in the endless war against high steam costs. It's quite another to find the winning tactics that rout fuel waste and high costs — that make them *stay licked.*

That's exactly how numerous executives—*shrewd strategists*—are winning on the boiler-room front: by utilizing Automatic Combustion Control. Hays Combustion Control *electrically* operated, measures every combustion factor, records every variation, instantly corrects those variations. It's simple, error-proof — AUTOMATIC.

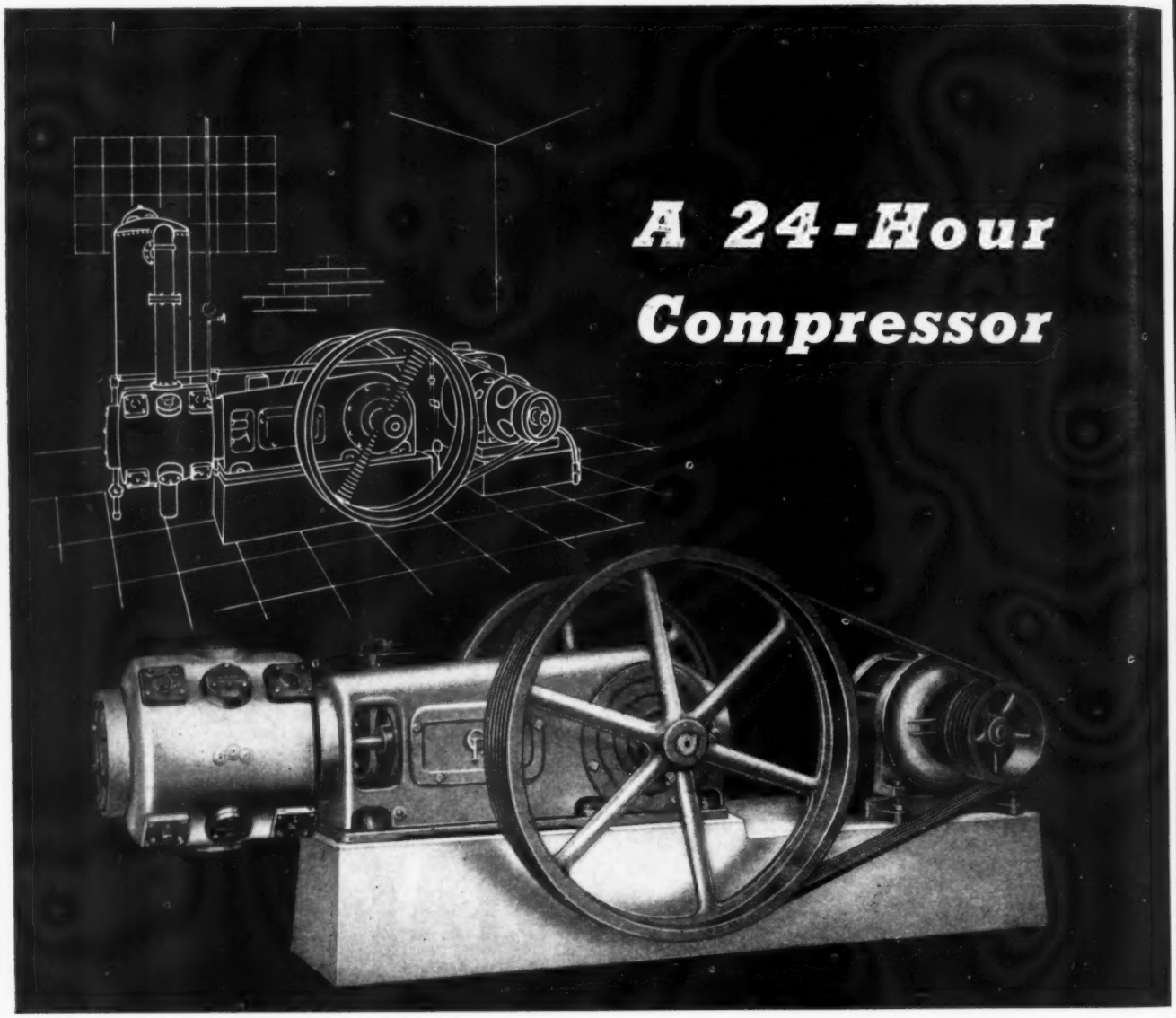
With plant capacities straining to meet war materiel needs, with new equipment barred, with man-power restricted, many plants have found Hays Combustion Control ideal and practical. It saves man-hours, works tirelessly, 24 hours a day . . . gets the utmost efficiency—cuts operating costs.

Smart tactics: send now for the Hays Combustion Control Catalog full of useful steam-power data, "must" literature for industrial strategists.

THE MODERN SYSTEM *It's Electrical*

HAYS *Automatic* COMBUSTION CONTROL

THE HAYS CORPORATION • MICHIGAN CITY, IND.



with high efficiency... low maintenance

THE CP Type T Compressor is a "wheel horse" for economical, continuous performance... keeps working away, year after year, with minimum maintenance. It is of the horizontal, single-stage, double-acting, water-cooled type, arranged for belt, direct-connected motor or steam drive. Simplate valves, liberal water jackets, one-piece trouble-free crosshead, double-row tapered roller main bearings are a few of the features responsible for its superior performance. Type T Compressors are available in sizes from 15 to 125 hp, in single-stage design for pressures up to 150 pounds, and in multi-stage units for pressures up to 5,000 pounds. Write for Bulletin 728.

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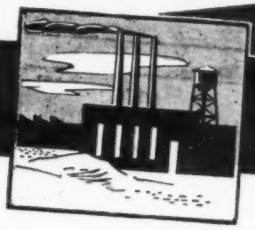

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from the Fundamental Prime Mover through the ultimate Power use.

• RECONVERSION OF WAR INDUSTRIES •

Geared to wartime operation, industry must plan reconversion to peacetime production. It is highly essential for economic reasons that plants be ready with no time loss involved when the change-over is required.

In reconversion, *power* is all-important. Power planning should start now. J. F. Pritchard and Company power engineers are thoroughly equipped to analyze your power problems—no matter how complex—and place before you a plan to assure ample power for your reconversion plans. J. F. Pritchard and Company, *Power Division,* Fidelity Building, Kansas City, Missouri.

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What do you mean—"GOOD COAL"?

Satisfactory performance on the combustion equipment is what makes "Good Coal". Inadequate or obsolete equipment often excludes excellent coal values from the acceptable list. A case in point — A large industrial plant in West Virginia always required special high cost coals until they redesigned and modernized their stokers and furnaces for a wide range of coals, which included the lower fusion Fairmont Coal. As a result, they now have flexibility to use several coals, but have standardized on Fairmont Coal because it produces the lowest-cost steam.

When you say "Good Coal" you mean the combustion equipment is properly designed for its use. The good coal which gives the highest "Dollar Efficiency" is the Best Coal. Plan to redesign and modernize your plant to burn Fairmont Coal and you will be completely satisfied, as is this Industrial Plant.

There is a definite trend among utilities and industrials in the East to specify latitude in equipment design enabling them to take advantage of the excellent value available in Fairmont Coal.

COAL BUREAU ENGINEERS CAN HELP YOU SAVE FUEL DOLLARS

The Coal Bureau is qualified by experience to render this service—to discuss economy in the use of coals and their availability—to help you modernize equipment to use them most advantageously. The Bureau is successfully rendering this service for others and can help you, too.

THE RIGHT COAL FOR LOWER STEAM COSTS

FAIRMONT-COAL (PITTSBURGH SEAM) is mined in an area which geologists agree contains the largest reserves of one kind of coal contiguous to the eastern seaboard. The seam ranges from 6 to 8 feet in thickness and is rated as one of the most inherently clean seams in America. Modern mechanized mining and preparation methods are used. Mines are located within easy, low cost transportation distance of about 75% of the nation's heavy industrial power plants. These factors add up to a perfect formula for industrial consumers who are interested in a sound long range fuel program.

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● Thanks to greatly increased facilities this superior K&M mounting material is immediately available for electrical installations of all kinds. K&M Ebonized Asbestos is ideal for switchboards, bus bar runs, testing tables, panel boards.

This modern mounting material is a combination of asbestos fibre, binding cement and insulating compound in proper proportions—molded under intense pressure into strong, monolithic sheets.

Developed especially for the electrical industry K&M Ebonized Asbestos has many important advantages. Among these are . . .

Exceptionally high dielectric strength.
Ability to withstand severe shock, wide temperature variations and vibration.
Resistance to oil and water action.
Freedom from shrinkage, cracking, bulging.

With our expanded production we can now supply you with K&M Ebonized Asbestos in 1/8 to 4 inch thicknesses, "standard" or special "panel" finish. K&M Ebonized Asbestos meets the technical requirements of the Underwriters Laboratories, Inc., when built into an assembled unit.

Our Ambler plants proudly fly the Army-Navy "E" flag with its star —an honor awarded K&M employees "for continued outstanding production of war materials."

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INCREASE FLOW CAPACITY 40% TO 60%

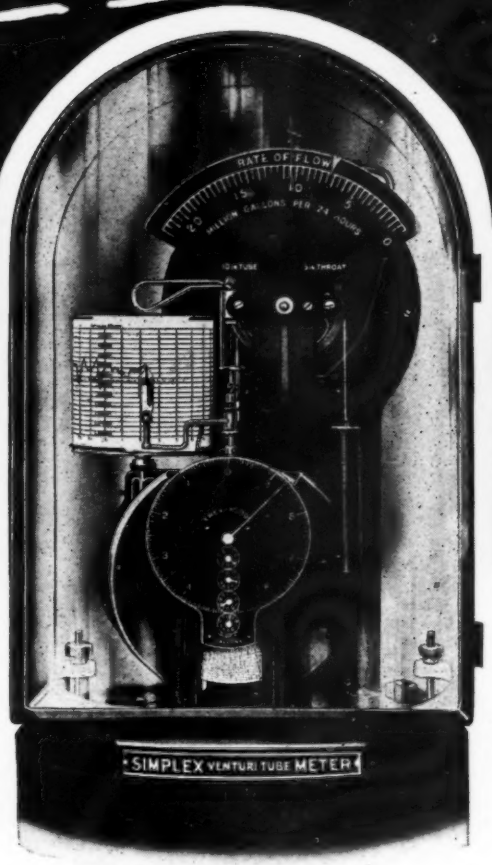
MOL or MOLA METERS

with flow ranges

FROM **20 to 1**

TO **28½ to 1**

OR TO **40 to 1**



Two typical examples of the ease and economy of increasing the maximum capacity of flow lines with the use of Simplex MOL and MOLA wide-range meters are given below:

1. **A change in operating heads enabled a large municipal water department to increase the total capacity of one of their pumps from a maximum of 60 million gallons per day to 72 million gallons per day by replacing the existing Simplex MO Meter with a Simplex MOL Meter. No change in the Venturi Tube, Pump Impeller, or motor was required, and operating costs showed a marked decrease.**

2. **By substituting an MOLA Meter for an MO Meter, increased requirements were met without any change in the Venturi tube, permitting an increase of from 13 million gallons per day to 21 million gallons per day.**

Simplex MOL and MOLA meters are designed to function over extremely wide flow ranges—and the accuracy of measurement and totalization is maintained at both maximum and minimum ends of the range.

Look into the advantages and economies of making use of Simplex instruments for performing the extraordinary as well as the conventional metering operation.

Write today; our recommendations are made without obligation.

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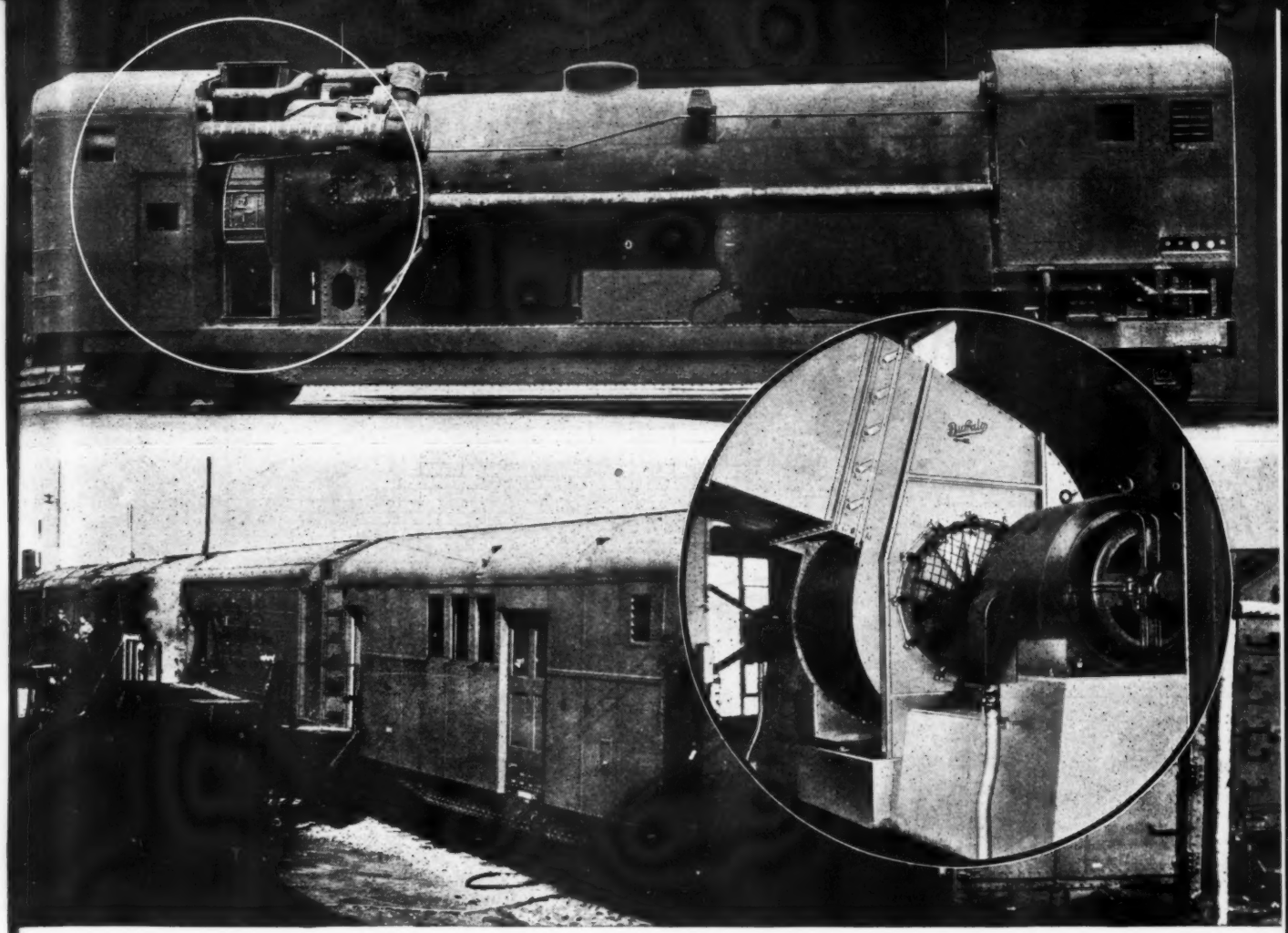

"Buffalo" Fans Supply Draft . . . for Mobile Power Plants

THIS BOOK, "Fan Engineering" deals with the theory and practice of handling air and gases mechanically. It is the air engineers reference on almost every industrial project built in U.S.A. in the past 30 years. Thousands of copies of this book are serving the contractors and operators of American and Allied armaments and munition plants.

Beautifully printed, indexed, bound in limp black fabricoid, you can buy these 740 pages of useful information for cost; $4.00 post paid in U. S. A.

★ The new "power plants on wheels" which can bring electric power wherever railroad tracks run are the finest that American engineering and American equipment can produce . . . they are built to operate far from replacements . . . and with a minimum of maintenance. Forty of these ten-car portable power plants are for repairs and rehabilitation in Russia, ordered by the Soviet Government.

These trains, built by General Electric Co. and American Car and Foundry Co., use Buffalo Fans to supply induced draft for the boilers. Naturally, we are glad to have Buffalo Fans on this exacting service, but engineers familiar with Buffalo design and "heavy-duty" construction can understand why Buffalo Fans were selected.

Other mobile power plants using Buffalo Draft Fans serve the U. S. Army and Navy.

In every field . . . on almost every continent . . . when you find a plant with a new process, or just a plain, hard job of air moving, you're apt to find Buffalo Fans. In the world's deepest gold mine, in Africa, Buffalo Fans deliver conditioned air deep in the earth. In the mercury-vapor power plant, built by General Electric Co., in Schenectady, Buffalo Draft Fans are used. The first airplane engine test set-ups used Buffalo Fans; most of those in service today also use "Buffalo." In the synthetic rubber industry, in dehydrating plants, plastic factories, rayon and nylon factories, chemical plants, explosive plants, and in tunnel ventilating systems, thousands of Buffalo Fans are in use.

And because "Buffalo" builds complete lines of fan equipment, on each job you'll find the *Right* fan, doing good work with little attention.

Buffalo Sales Representatives are trained air engineers. They will be glad to work with you or your consulting engineers. Why not enjoy the advantages which you get with Buffalo Fans?

"Buffalo" "First For Fans"

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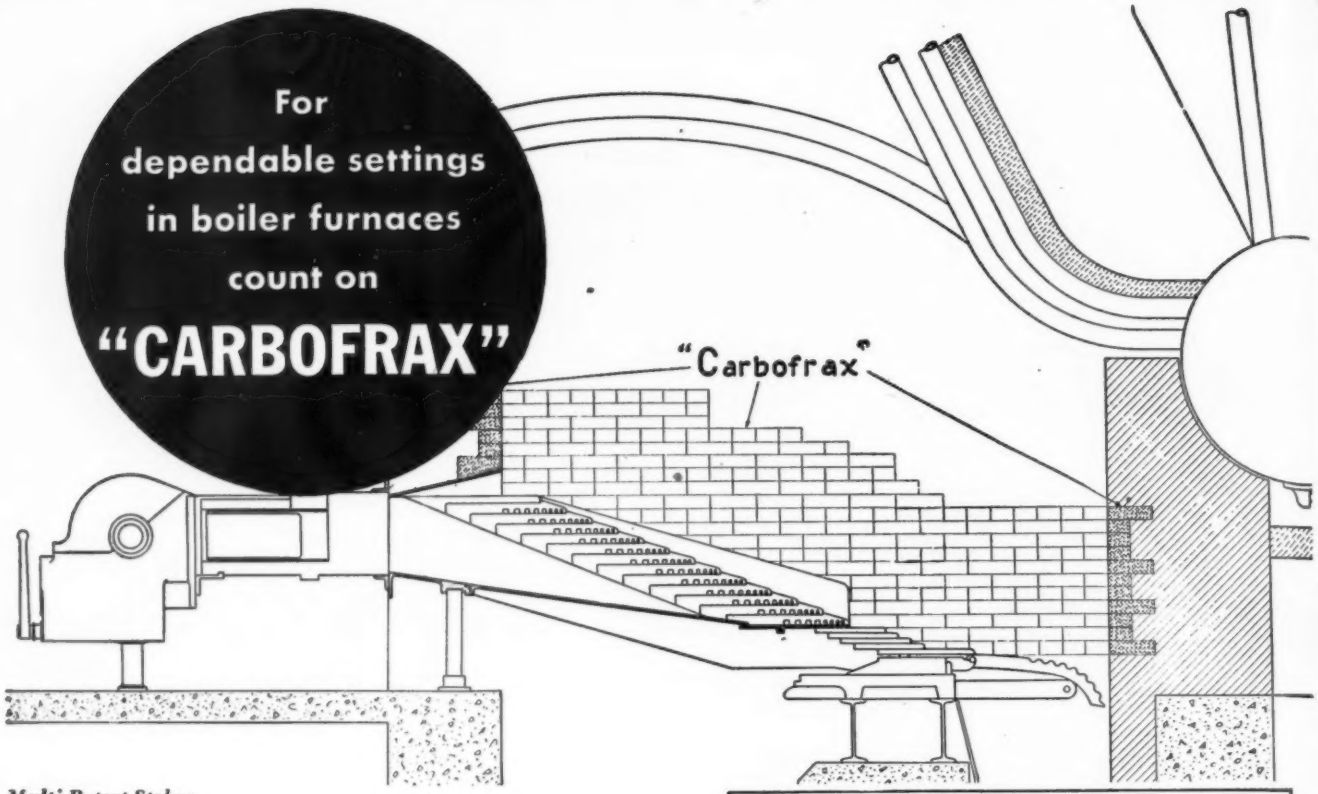
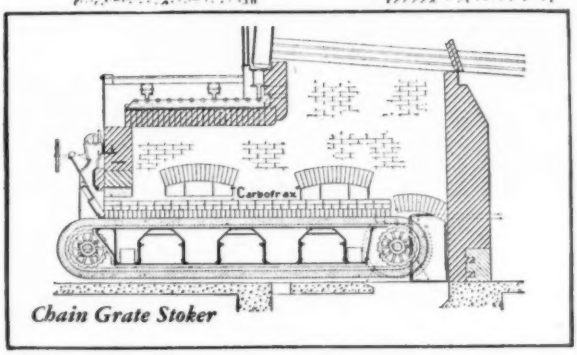
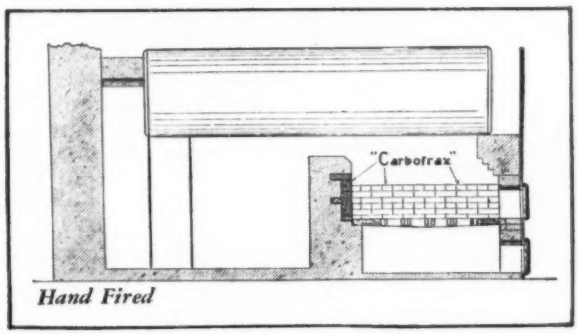


Multi-Retort Stoker



Chain Grate Stoker



Hand Fired

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1. Maximum steam production—Massive clinker formations that restrict the fuel bed never build out on the hard, dense face of "Carbofrax" brick. Thus, you obtain greater efficiency because the full effective grate area is always maintained.

2. Improved continuity of operation—With "Carbofrax" on the job, outages due to lining failures are few and far between. "Carbofrax" is highly refractory and does not burn or cut back. It is also extremely resistant to flame and mechanical abrasion. Hence, a good foundation for the upper walls is assured.

3. Reduced labor—The furnace walls are easy to clean. The fire is more active. Frequent shutdowns are eliminated.

4. Lower operating costs—Eight to ten years' service is not unusual for "Carbofrax" boiler furnace linings. Think what this means in terms of lowered material and labor costs.

Several thousand installations have proved a "*Carbofrax*" setting to be a *dependable* setting. Whether your boiler furnaces be stoker- or hand-fired, you'll find "Carbofrax" worthwhile insurance for efficient and economical operation. Write today for "*Carbofrax* in Boiler Furnaces."

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Super Refractories by CARBORUNDUM
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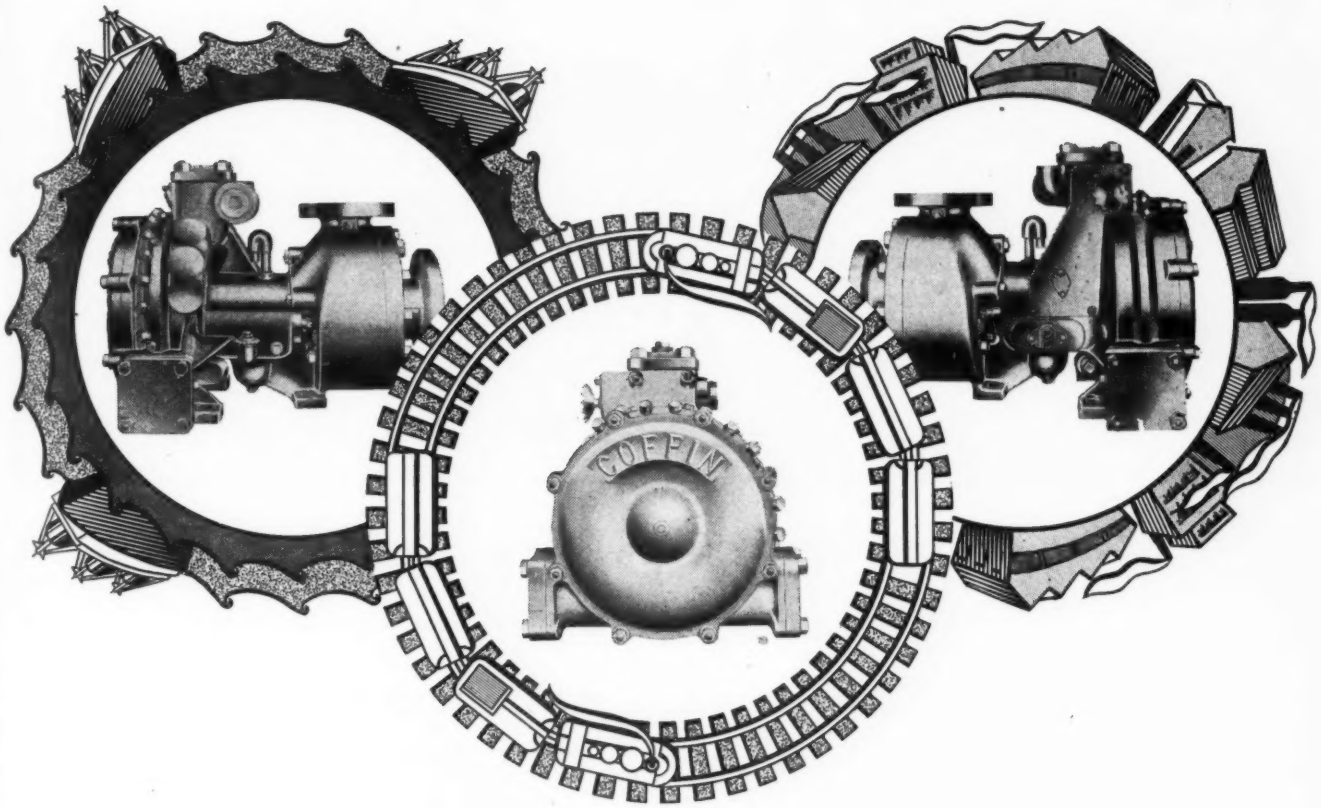
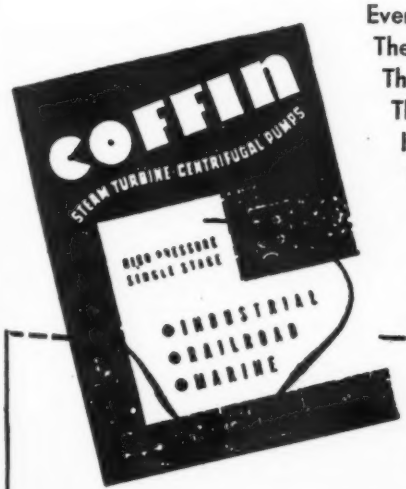
Afloat • On Rails • Stationary
STEAM BOILERS MUST BE FED



COFFIN—*Steam Turbine* CENTRIFUGAL PUMPS *Meet that Must*



Every industry has its particular reason for favoring the Coffin Turbo Pump. The Marine Industry like its compact size, for space is often at a premium. The Railroad Industry like its light weight for weight on rails is an economic factor. The Stationary field like its steam consumption economy.

In every industry its dependable operation and low upkeep has made it a favorite of operating engineers and management alike.

Save space, weight and steam. Make your next pump a Coffin Turbo Pump.

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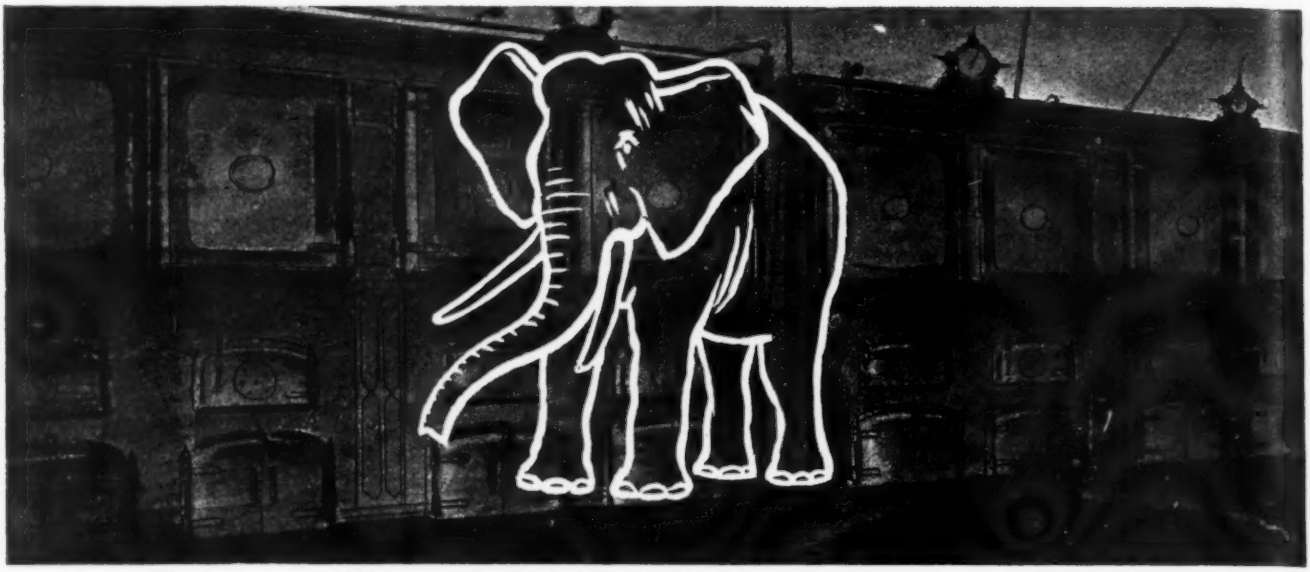

IN YOUR BOILER PLANT?

MODERNIZE HEAT AND POWER EQUIPMENT WITH DEPENDABLE, EFFICIENT TODD BURNERS

POST-WAR competition is going to be tough—no doubt about that. The manufacturer whose operating costs are low will have a head start. An inefficient boiler plant can inflate your whole price structure. Start paring *your* costs now, by modernizing your heat and power plant immediately.

Owners and operators of plants of all types in many states have taken this forward looking step, by installing TODD oil or gas burners. *Many report fuel savings as high as 10%, and over 10% increases in heat and power output!*

TODD engineers will survey your boiler plant without obligation and recommend the most effective set-up for your operations. Continuing research in combustion engineering has made TODD the leader in designing and manufacturing liquid and gaseous fuel-firing equipment. This insures TODD users of the highest efficiency and lowest operating and maintenance charges.

Take advantage of TODD leadership *to reduce the cost of producing a pound of steam* in your plant. Call on TODD engineers for a consultation.

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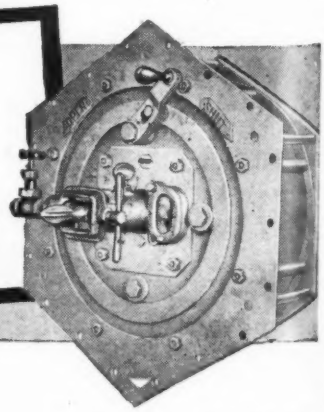
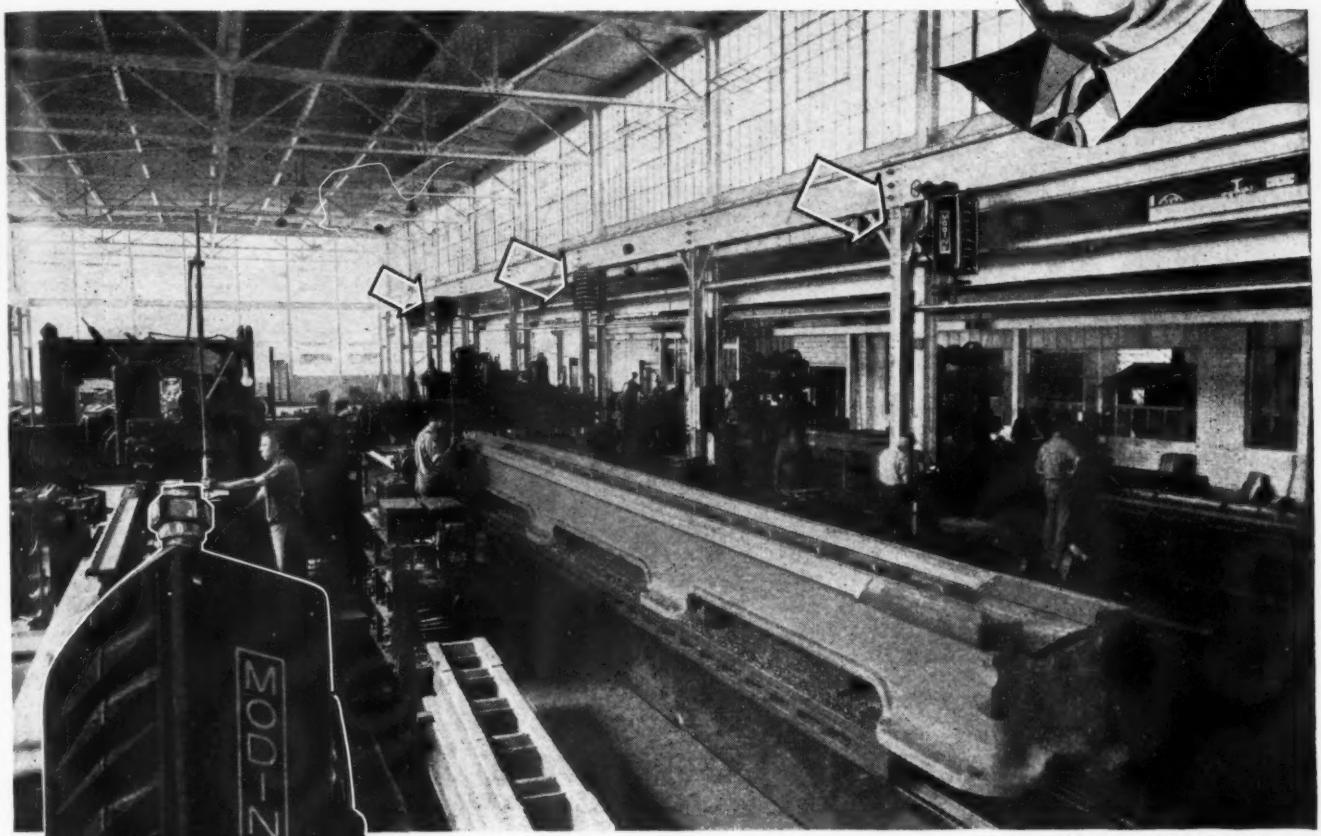


ON THE FIRING LINE OF AMERICA'S WAR FRONT

THE PLANT ENGINEER CALLS 'EM SOMETHING ELSE... BUT I CALL 'EM

Human Maintenance



Courtesy The Monarch Machine Tool Co.

HORIZONTAL DELIVERY MODEL

VERTICAL DELIVERY MODEL

"Our Plant Engineer has an eye on fuel saving—in wartime more than ever . . .

"Our old heating system actually *wasted* fuel. Pipe coil was always springing leaks and radiators going dead. When the Plant Engineer wasn't making repairs, he was explaining to the Old Man why maintenance costs and fuel bills kept going higher and higher . . . and why every time the temperature dropped, plant production took a nose dive.

"Then they put in Modine Unit Heaters. Now we have heat *where* we want it *when* we want it. We're saving fuel—as much as 25% over cast iron radiation! And saving repairs, too. The Plant Engineer says 'Modines are preventive maintenance' . . .

"But I call Modines *human maintenance.* Modines automatically maintain even temperatures. Workers catch cold less often. Long absences due to illness are fewer. Everybody is healthier and happier; their production proves it!"

Write for Descriptive Catalogs 144 and 144-A

Look in your phone book for Modine representative's name—"Where to Buy It" section.

ARMY E NAVY

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UNIT HEATERS

MODINE MANUFACTURING COMPANY. 1830 RACINE STREET, RACINE, WISCONSIN

B-17 Flying Fortresses on raid over Stuttgart, Germany, Sept. 6, 1943. A. A. F. photo

. . . in reply to yours of December 7th

Ever since Pearl Harbor, the Sloan Valve Company has been working day and night turning out various items of war matériel. We have produced millions of parts for airplanes, guns, tanks, armored vehicles and ammunition fuzes—each accurately machined to micro-tolerances. Sloan employees have worked diligently and with meticulous care to maintain the accuracy required in their work and the urgent delivery schedules demanded by the progress of the war.

But while we were busy at this war work, Sloan engineers developed the emergency VICTORY Model Flush Valve which has conserved thousands of tons of copper, *plus* developing new and improved flush valves for after-war production. Sloan Flush Valves have always been precision-made water measuring instruments—small wonder there are more Sloan Flush Valves sold than all other makes combined.

SLOAN VALVE COMPANY

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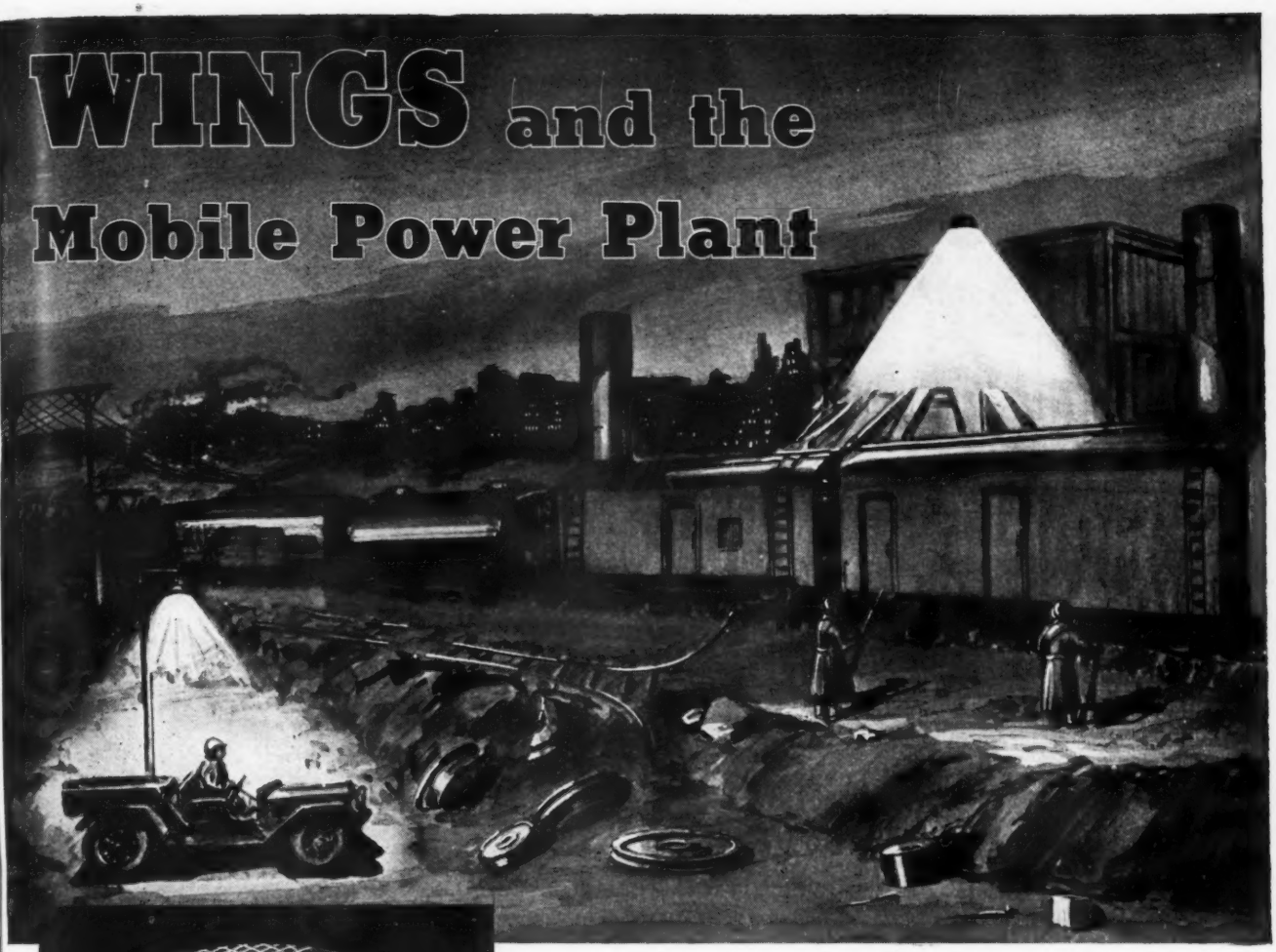
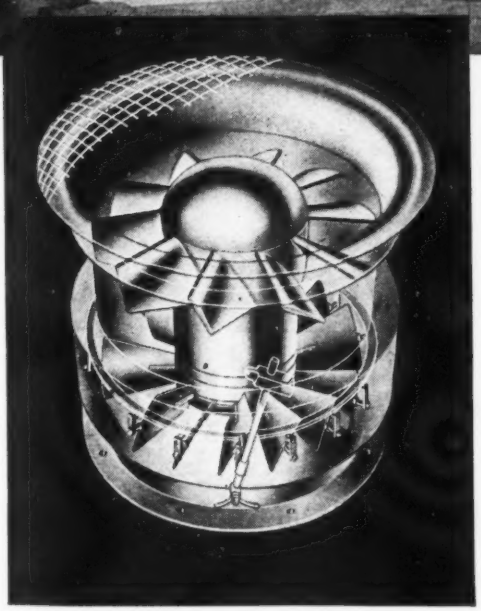
WINGS and the Mobile Power Plant





WING EMD Blowers Supply Forced Draft to New 5,000 Kw Generating Plant on Wheels

When the Russian army started moving the German armies out of the lands they had over-run in 1941 and '42, they found ruin and desolation wherever the bloody boot of the Nazi had trod. With the determination of a victorious people, they started to re-build. Now as the sweep of victory moves on, they are finding new ways of hastening the rehabilitation of their ruined cities and towns.

Most spectacular of these new methods is a mobile power plant, built by Westinghouse—a complete central station, consisting of boilers, turbine and generating equipment all carried on one single railroad train. As the Nazis are moved out, the train rolls in, lines are set up and electric current flows out to the devastated community.

The L. J. Wing Mfg. Co. has been privileged to furnish Wing Axial Flow Blowers to supply the forced draft for the boilers—built by Combustion Engineering Co.—and it is interesting to realize that the same Wing Axial Flow Blowers that are helping in a modest way to bring light and power to devastated Russia, are also at work on the battle fronts of the world, helping—in LST ships, battleships, destroyers, airplane carriers, tugs, tenders, minesweepers and in army camps—to bring Victory closer.

L. J. Wing Mfg. Co.

50 Seventh Avenue New York 11, N.Y.

Factories: Newark, N. J. and Montreal, Canada

TURBINE BLOWERS | MOTOR DRIVEN BLOWERS | DRAFT INDUCERS

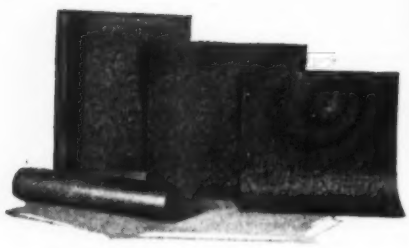
STEAM TURBINES | FOG ELIMINATORS | PROCESS HEATERS

WING

REVOLVING UNIT HEATERS | UTILITY HEATERS | FLOODLIGHT HEATERS

VENTILATING FANS | EXHAUSTERS | SHIP VENTILATORS

Garlock Helps Fuel the Bombers to Blast the Axis



GARLOCK 7021 Compressed Asbestos Sheet Packing is a superior gasketing material for severe conditions, such as super-heated steam at extreme pressures and light oils at high temperatures. Thicknesses $\frac{1}{64}$" to $\frac{1}{4}$". Sheets 40" x 40" and larger.

Our big 4-engined bombers with their loads of blockbusters use tons of gas on every mission. The dependable performance of GARLOCK packings, gaskets and KLOZURE oil seals in the production, refining and transportation of petroleum products, helps keep our planes supplied with fuel.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada:
The Garlock Packing Company of Canada Ltd.
Montreal, Que.

GARLOCK

LOMBARD PUMPS NEW LIFE TO CALIFORNIA BADLANDS

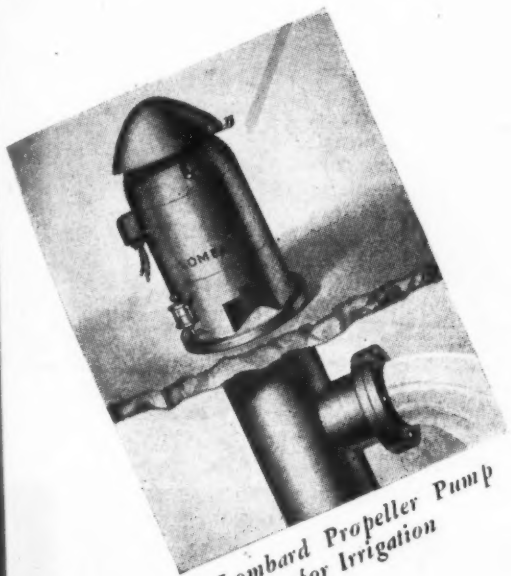
LG

21,600,000 gallons of precious water per day is the capacity of Lombard's giant pumps, designed to reclaim thousands of acres of arid western land for the farmers of the future.

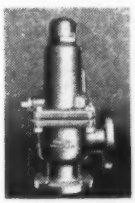
But whether it's 15 or 15,000 G. P. M.; whether it's a vertical, close-coupled or submersible pump; Lombard's 50 years of applied experience and world-wide acclaim for her craftsmanship are the guarantee of durable, economical and trouble-free performance.

Also serving the nation's war machine, agriculture, shipping and industry are Lombard's famed Water Wheel Governors, Variable Speed Drive, Relief Valves and other hydraulic control units.

In War and in Peace, Lombard's advanced hydraulic and engineering skill continues to enhance her leadership in these fields. Our staff of specialists is at your service.



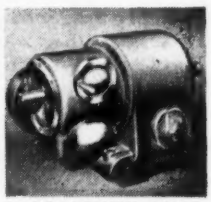
Lombard Propeller Pump for Irrigation



RELIEF VALVE

CENTRIFUGAL PUMP

WATER WHEEL GOVERNOR



VARIABLE SPEED DRIVE

LOOK TO WHEN YOU LOOK TO THE FUTURE

LOMBARD GOVERNOR CORPORATION

Sales Office • 60 E 42nd St. • New York

ASHLAND • MASSACHUSETTS

Sure, All Valves Look Alike

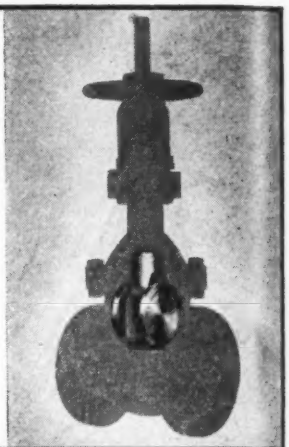
But..It's What's Inside That Counts!

Any engineer will tell you there isn't much difference in the outside appearance of most gate valves. Why should there be? It's the *inside* story that really counts. And it's that same inside story—the assembly—the simplicity of design—the rugged construction—the leak-proof machined surfaces—that has made the Darling Parallel Seat, Double Disc Gate Valve a leader in the field for more than forty years.

No. 1

THE ASSEMBLY-ONLY 4 PARTS

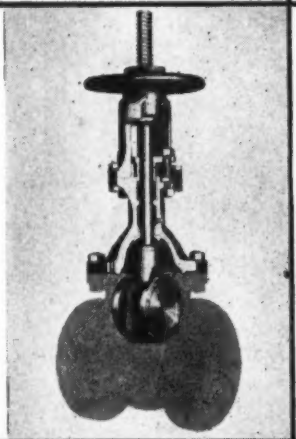
Two discs and two wedges—the entire working part assembly of a Darling Double Disc Gate Valve. There is no other valve with this design. The seats are parallel. The discs are *fully revolving*, seating in a different position each time the valve is operated.



No. 2

QUICK AND EASY TO REPACK

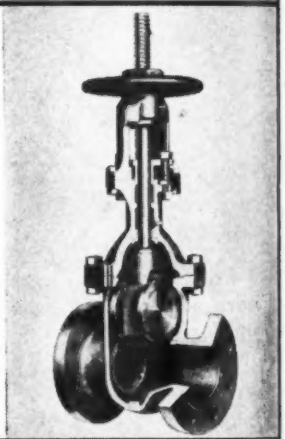
It's inside refinement like this that counts in a gate valve. The Darling Stem Collar is machined to tightly seat against the bonnet bushing. This permits *repacking* of the valve *in* service. The Valve Bonnet has two separate chambers, the lower being a condensation chamber protecting the packing above. This permits sampling or pressure relief while repacking stuffing box.



No. 3

DENSE CASTINGS THAT ASSURE GREATER STRENGTH

There are no "lot" testings. The body of each and every Darling Valve, like all other parts, is tested individually to its rated pressure. There are no sharp corners. Generous radii throughout eliminate casting strain and insure maximum strength. Darling Valve bodies are designed for quick, easy and inexpensive parts replacement.



No. 4

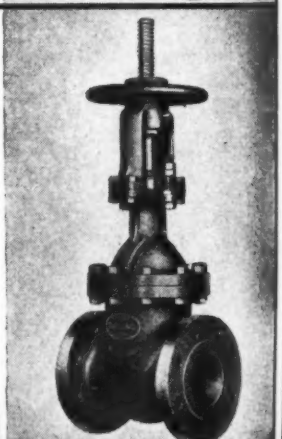
NO LEAKAGE AT ANY PRESSURE

When the discs roll into place and the parts are sealed, there is no leakage. There can't be. All seating surfaces, by special Darling processes, are super-machined to a glass-like surface that assures a complete seal for any fluid or gas passing through the line.

No. 5

THERE'S A DARLING VALVE FOR YOUR TOUGHEST JOB

No matter what that tough job involves, corrosive or erosive materials, high or low pressures or temperatures, special alloys, unusual installations, severe operating conditions, where those problems occur, that's the place Darling Gate Valve design can positively prove its value. Write for the new Darling Catalog and Data Book.



Darling manufactures a quality line of longer-lasting Gate Valves. They come in Fully Revolving Double Disc, Parallel Seat, also in Taper Seat—Slotted and Solid Wedge types. In service pressures up to 3000 pounds, available in Cast Iron, Bronze, Forged Steel, Cast Steel, and Corrosion Resistant Alloys. Darling also manufactures Compression Type Fire Hydrants, Check Valves, Motor and Cylinder Operated Valves, and many accessories.

DV-43-102

TRADE DARLING MARK

VALVE & MANUFACTURING CO.

WILLIAMSPORT, PA.

A CHOICE THAT CAN BE IMPORTANT

MIDWEST "STANDARD" BUTT-WELDING ELBOW

MIDWEST "LONG TANGENT" BUTT-WELDING ELBOW

. . . . and ONLY MIDWEST offers THIS CHOICE

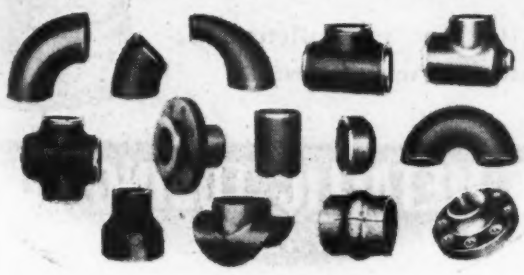
Before you select welding elbows to use on any given piping job, it will be worth your while to consider the relative values of the two elbows shown. On some jobs the correct selection can mean a real saving of time and money. Only Midwest offers you the choice of either type elbow . . . and there is no difference in price.

The "American Standard" elbow has a center-to-end dimension equal to one and one-half times the nominal pipe size. The Midwest "Long Tangent" elbow has a center-to-end dimension of one and three-quarters times the nominal pipe size; it has tangents (straight ends) equal to one-fourth of the nominal pipe size.

These long tangents make it possible for pipe and fitting to be lined up more quickly and accurately. Less pipe is required, a short nipple and an extra circumferential weld are frequently eliminated, and slip-on welding flanges are more easily used.

Both elbows have all advantages of the unique Midwest manufacturing process: final working of the metal in compression (which means exceptional dimensional accuracy and uniformity), stress relieving, exact included angle, true circular section and uniform wall thickness.

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS



MIDWEST

PIPING & SUPPLY COMPANY, INC.

Main Offices: 1450 South Second St., St. Louis 4, Mo.

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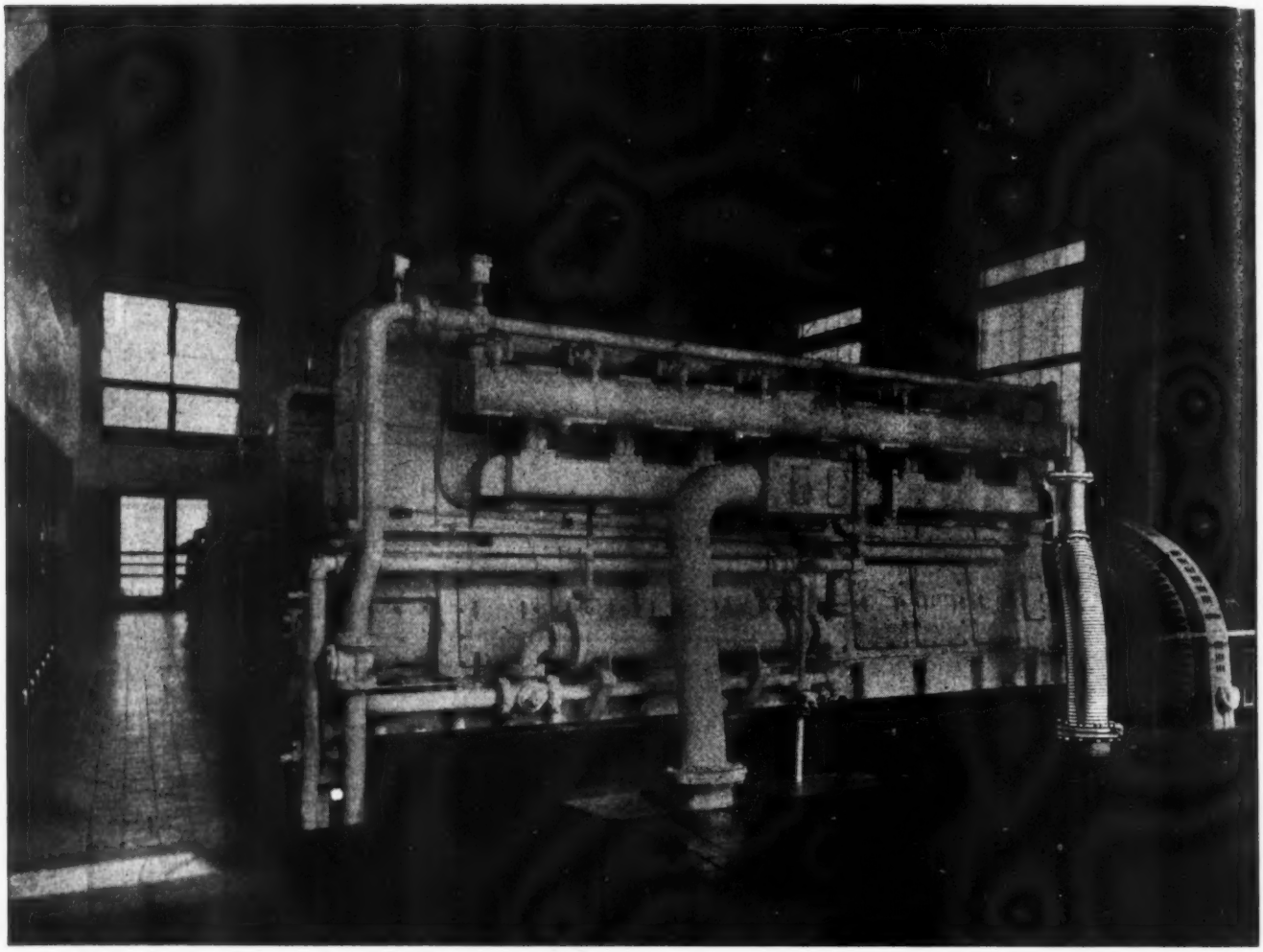

PENFLEX FLEXIBLE METALLIC HOSE with

Armored Flexibility for Safety and Service

Important factors in generating power are Service and Safety. That's why PENFLEX is found on many generator sets in power plants throughout the country. PENFLEX with 4-wall interlocking joint construction gives long life and trouble-free service on intake and exhaust lines, oil, water and other connections. It resists thermal and mechanical strains and fatigue; absorbs vibration and provides safety plus economical service.

For fuel oil feed, starting air and manifold drain lines, the corrugated, jointless construction of PENFLEXWELD provides flexibility, expands or contracts easily with changes of temperature, pulsation of pressure, and remains unnoticed because of its almost completely trouble-free service.

Full data on PENFLEX All-Metal Pipes for Diesels in Bulletin 71. PENFLEXWELD is described in Bulletin 90. Write for these Bulletins.

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.

7238 Powers Lane, Philadelphia 42, Pa.

ESTABLISHED 1902

KEELER CP STEAM GENERATOR

Saves you money three ways

1 TAKES LESS FUEL
2 TAKES LESS MAINTENANCE
3 TAKES LESS ROOM

Reasons

1–Rapid Circulation
2–Long Gas Travel
3–Staggered Tube Spacing
4–Built-In Soot Blower
5–Water-Walled Furnace
6–Minimum of Brick Work
7–Steel Cased and Insulated
8–Quick to Respond
9–Easy to Clean
10–Compact and Efficient

Capacities to 100,000 lbs of steam per hr. Pressures to 500 lbs p.s.i. Suitable for any type of stoker, oil burner, powdered fuel, gas, bagasse or waste heat. Over 1000 in use in the United States, Canada and other foreign countries. Repeat orders over 10% of total. Patented in the U. S. #2097268 —Patented in Canada #372802.

E. KEELER CO.

BUILDERS OF BETTER BOILERS SINCE 1864

WILLIAMSPORT, PENNA.

MANUFACTURED IN CANADA BY CANADIAN VICKERS LTD. OF MONTREAL

E. KEELER CO., WILLIAMSPORT, PENNA.

Send copy of Bulletin F9-3 to

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TITLE .....

FIRM .....

ADDRESS .....

Actual photo of a Gulf Service Engineer (right) consulting with municipal power plant operating Superintendent on Diesel engine lubrication.

"We've had 18 years of dependable low-cost service from this Diesel with Gulf Parvis Oil —

says this Superintendent

no operating troubles, no repairs to lubricated parts"

IT sure has paid us to use a quality Diesel lubricant," says this Superintendent. "With Gulf Parvis Oil we've had dependable low-cost service from this unit since it was installed in 1926—no operating troubles, and no repairs to lubricated parts."

To help keep your Diesels delivering maximum kw.-hrs. at minimum cost for maintenance, take a tip from this and many other power plants that report better lubrication with Gulf Parvis Oil.

Gulf Parvis Oil provides greater protection for hard-to-replace parts—helps prevent excessive wear that leads to shutdowns, below-par operating efficiency, and high maintenance costs. Gulf Parvis Oil offers you proven performance and long life!

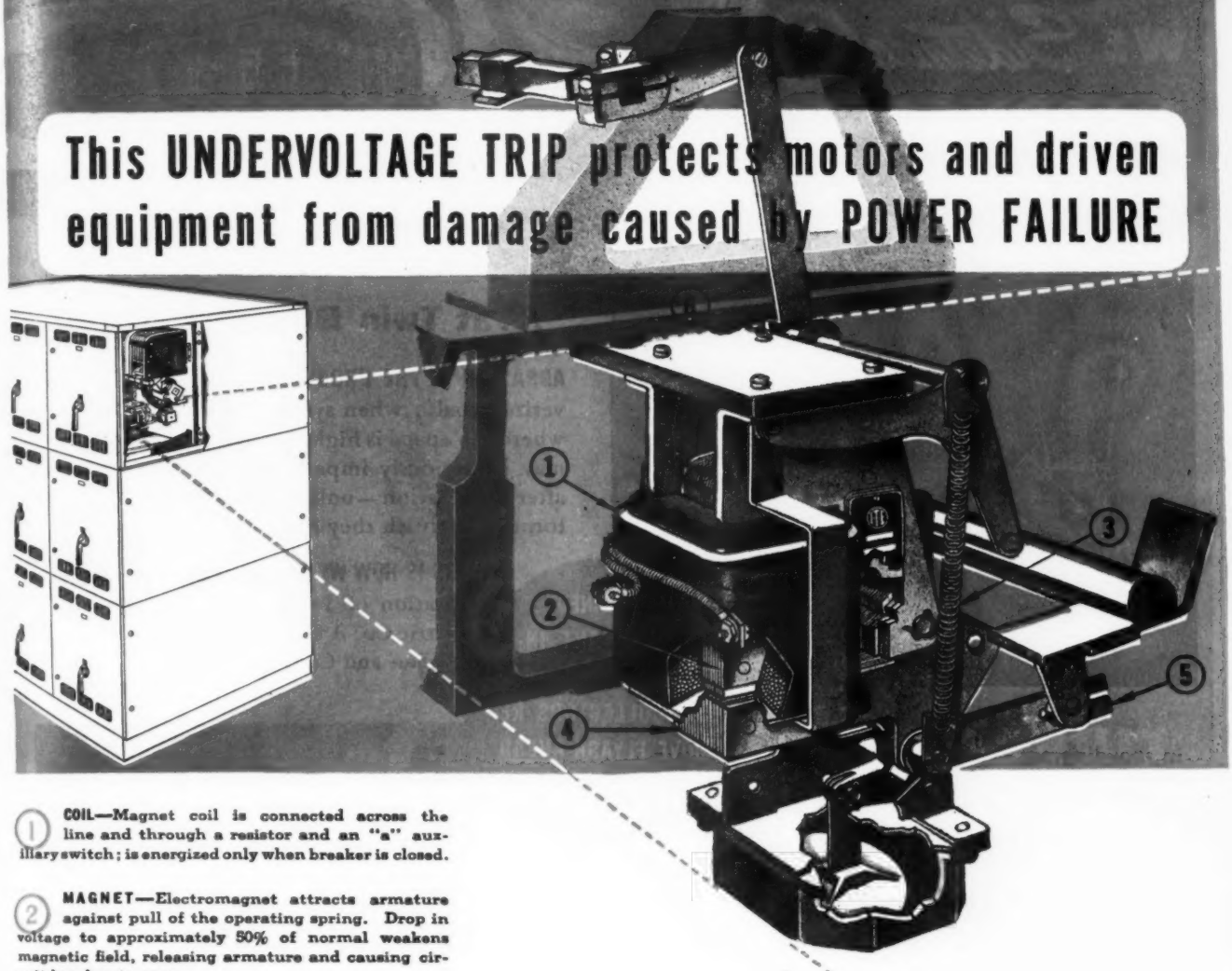
Call in a Gulf Lubrication Service Engineer today and ask him to recommend the proper grade of Gulf Parvis Oil to fit your particular requirements. Write, wire, or phone your nearest Gulf office.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company · Gulf Building, Pittsburgh 30, Pa.

Features of I-T-E DRAWOUT SWITCHGEAR

This UNDERVOLTAGE TRIP protects motors and driven equipment from damage caused by POWER FAILURE



1. **COIL**—Magnet coil is connected across the line and through a resistor and an "a" auxiliary switch; is energized only when breaker is closed.

2. **MAGNET**—Electromagnet attracts armature against pull of the operating spring. Drop in voltage to approximately 50% of normal weakens magnetic field, releasing armature and causing circuit breaker to open.

3. **OPERATING SPRING**—When circuit breaker is open, spring holds armature against faces of magnet poles. When circuit breaker is closed a change in position of the linkage makes spring tend to pull armature away. Magnet resists this action.

4. **ARMATURE**—Attracted by magnet against the pull of the operating spring when circuit breaker is closed. Release of armature opens breaker through link to tripper bar.

5. **LINK TO TRIPPER BAR**—Transmits movement of armature to trip mechanism that opens breaker when pull of operating spring overcomes attraction of magnet because of undervoltage condition.

6. **SPRING ARM LINK**—Attached to circuit breaker mechanism at upper end. Releases linkage so that operating spring holds armature against pole faces of magnet when breaker is open. When breaker is closed, it sets arm so that spring tends to pull armature away from pole faces.

Hazards arising from power failure are well known to operating men. The unexpected slowing or stopping of motor drives followed by equally unforeseen resumption of full speed can give rise to conditions damaging for d-c armatures and a-c windings, can do harm to machining and processing equipment, can injure workmen.

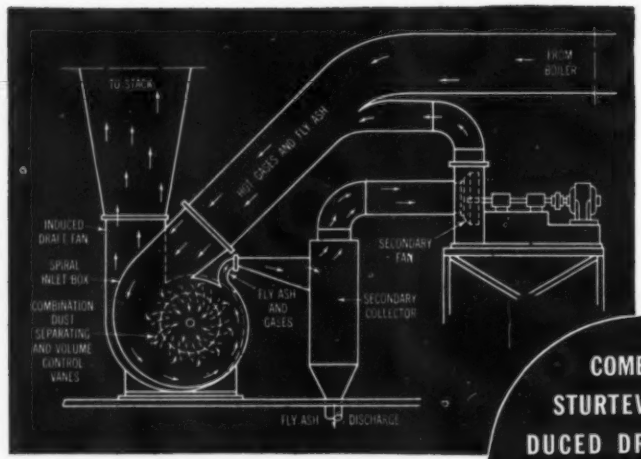
Protection against "undervoltage" is simple in principle. A drop to a predetermined, critical value causes a magnet to release an armature and the breaker opens. From that point, there need be no damaging current or unforeseen resumption of power or load.

Simple as this is, what you want on the part of the undervoltage trip is positive, dependable action. This I-T-E gives you—and we will gladly tell you about it to the last detail. Just call the nearest I-T-E representative or write to I-T-E Circuit Breaker Co., 19th and Hamilton Streets, Philadelphia 30, Pa.

Representatives in Principal Cities

I-T-E AIR SWITCHGEAR

WE *Sidetracked* A TORNADO!

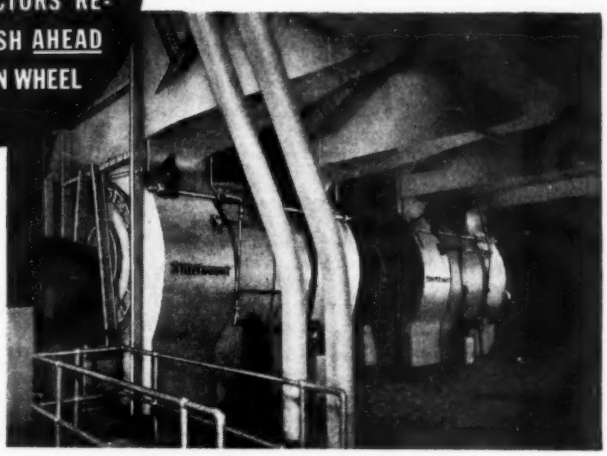


...at Twin Branch Station!

ABRASION IS THE PROBLEM...when burning pulverized coal...when system resistance is high...where fan speed is high. Induced draft fan wheels may be seriously impaired within a few months after installation—unless protected against the tornado of flyash they handle!

THIS IS HOW WE SOLVED IT for Twin Branch Station of Indiana and Michigan Electric Co. A combination Induced Draft Fan and Collector System—as shown in the diagram—sidetracks flyash before it hits the wheel! Even though a large portion of the flyash particles will pass through a 325 mesh screen, this SAID system removes a high percentage of the fine as well as the heavier cinders.

COMBINED STURTEVANT INDUCED DRAFT FANS AND COLLECTORS REMOVE FLYASH AHEAD OF THE FAN WHEEL



WITH THESE RESULTS: in operation for three years now at Twin Branch, the induced draft fans show practically no sign of wear—no loss of efficiency—maintenance and fan outage cut to the minimum. This SAID system is now in operation in several of the country's outstanding power plants—successfully solving the problem of flyash.

Sturtevant "Know How" Is Ready To Help Solve Your Conversion Problems

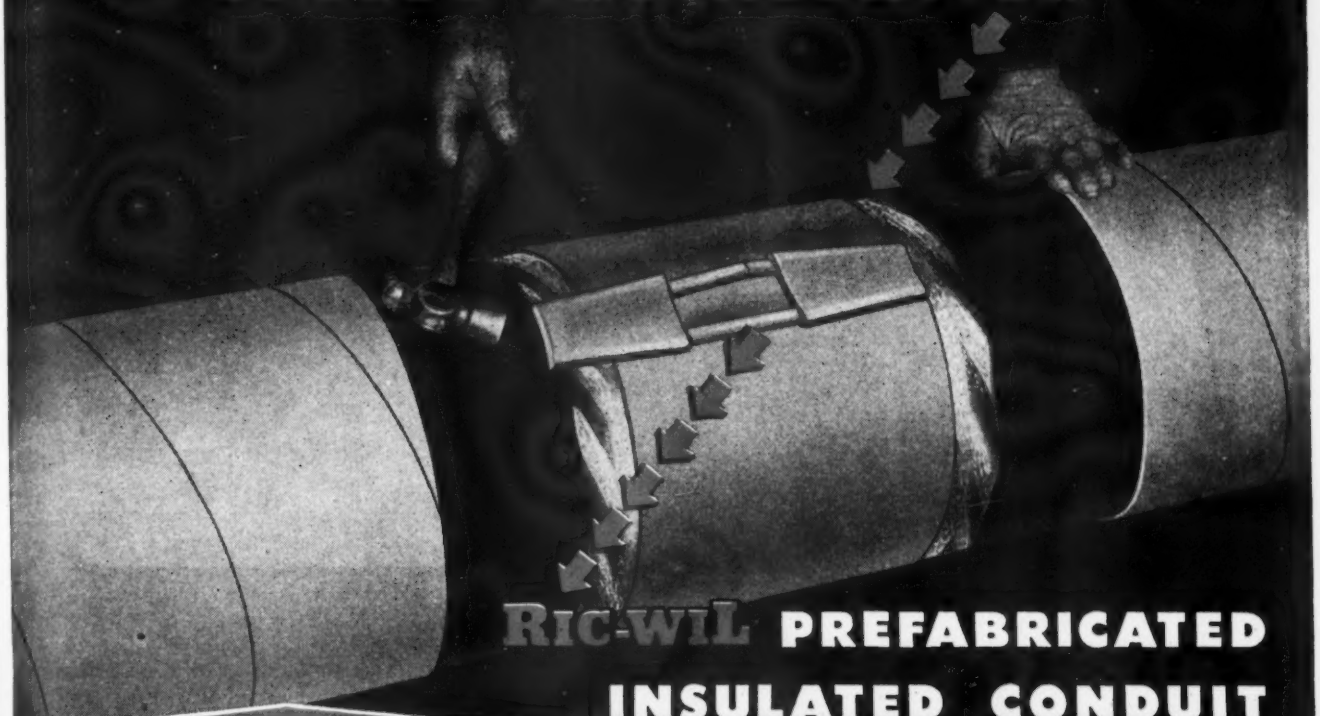
Conversion plans for most Industrial and Utility Power Plants include higher capacity ratings and increased system resistance. That means flyash or other dust collecting problems that Sturtevant can help you solve *now*. The SAID Fan System is only one of many developments made possible by the exhaustive research of the Sturtevant Dust Control Laboratory. This same "know how" and experience are yours to command—in the fight against destructive dust whenever it menaces efficient and economical production.

B. F. STURTEVANT COMPANY • *Hyde Park, Boston 36, Mass.*

Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

SYSTEMS and EQUIPMENT
Engineered for Efficiency in
Heating
Ventilating
Air Conditioning
Dust and Fume Control
Pneumatic Conveying
Vacuum Cleaning
Mechanical Draft

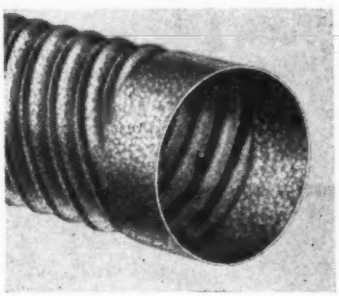
SIMPLE MECHANICAL COUPLER SPEEDS INSTALLATION



RIC-WIL PREFABRICATED INSULATED CONDUIT

for piping steam, oil or process liquids

Conduit Ends Expanded Smooth to Facilitate Tight Closure



Special machines at the factory remove corrugations from ends of conduit for a distance of 3", so that coupler sleeves will make a positive, watertight closure when units are joined in the field. Prefabricated expansion loops, elbows and tees also have ends expanded smooth for joining with straight units. The result is a permanent, pressure-tight system, requiring no maintenance.

Field assembly of Ric-wiL Prefabricated Insulated Pipe Units has been greatly simplified by a drive coupler, minimizing the need for skilled workmen, and still further reducing installation time. After pipes are coupled or welded and insulation applied, a split connector sleeve is slipped over the opening. Clamps are driven in place (see illustration) drawing the coupler tightly over the conduit ends, from which corrugations have been removed at the factory. An asphalt blanket is then applied with heat over the entire uncovered area.

Saves Time and Labor if Welded Closure is Required

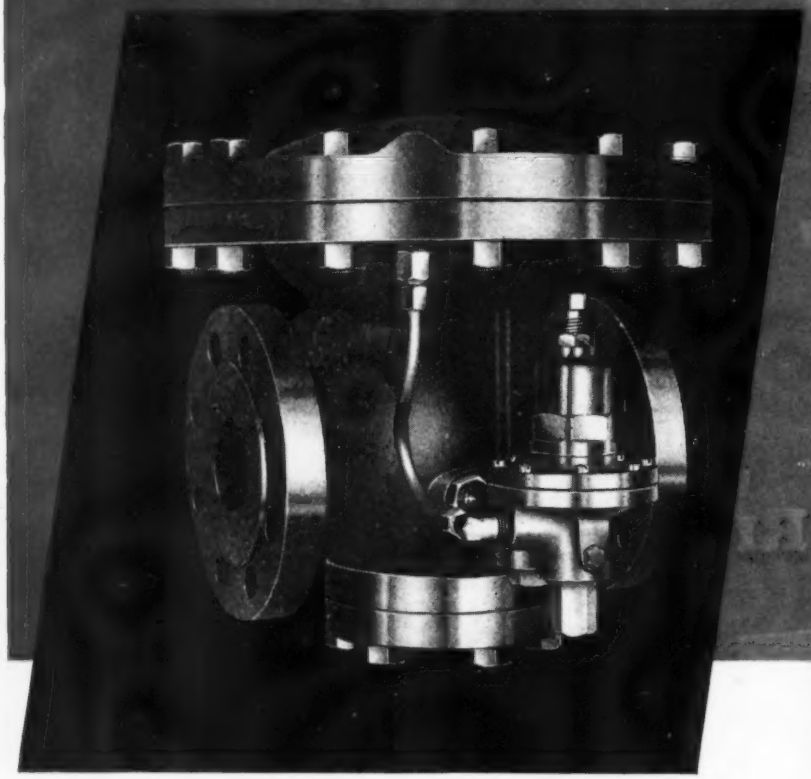
The combination of smooth, round expanded ends and drive coupler makes possible a strong, tight welded connection with a minimum of field labor. Clamps are first driven on channels, holding coupler firmly in place while circumferential seams are welded. Clamps are then removed, and longitudinal seam welded.

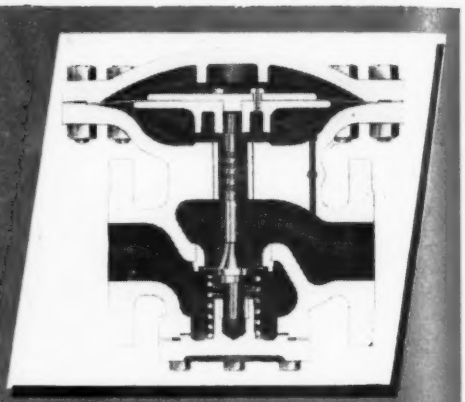
Write for the new Ric-wiL Catalog

RIC-WIL INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

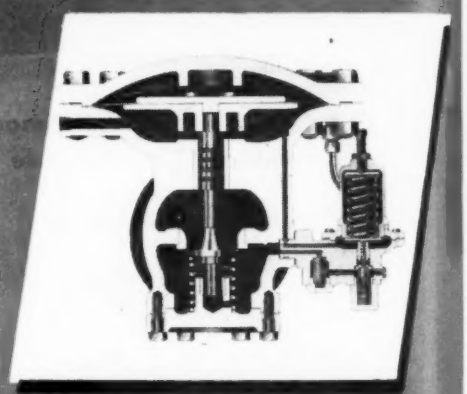
SPECIALLY DESIGNED FOR STEAM PRESSURE CONTROL

FISHER TYPE 92

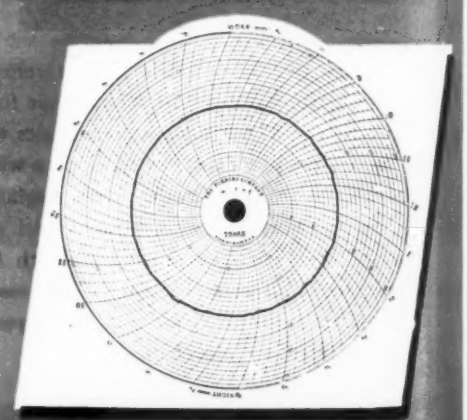




Sectional view showing inlet and outlet passages.



Sectional view showing cross section of pilot assembly.



Extremely close regulation. Constant reduced pressure 15 lbs. Inlet pressure 80-100 lbs. A typical Type 92 record.

The universal preference of power engineers for the Fisher Type 92 is based on the outstanding performance and reliability of this automatic controller for steam pressure regulation. It offers you these advantages:

ACCURATE . . . pilot control is extremely sensitive to flow changes — accurately maintains desired reduced pressure. *FLEXIBLE* . . . two pilot assemblies for high or low pressure service, easily adjusted to your requirements. *STURDY* . . . high-tensile bodies and diaphragm casing of rugged ribbed construction — inner parts Duromite bronze or stainless steel as ordered. *COMPACT* . . . but has unusually large capacity. No special wrenches needed for servicing. Ten sizes, ½" to 2" screwed or 1" to 6" flanged.

Write today for Bulletin C1 — it gives complete specifications.

FISHER GOVERNOR CO.

433 FISHER BUILDING • MARSHALLTOWN, IOWA

KEROTEST

STEEL

for over 2 decades

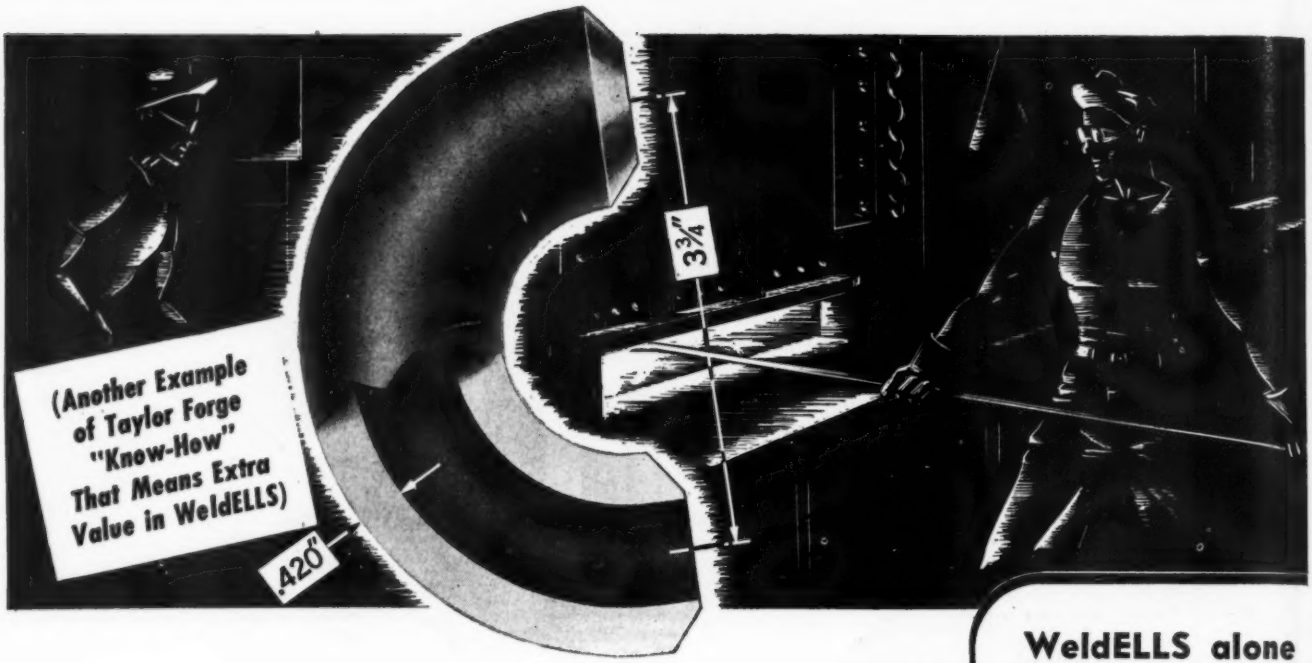
A TRADE NAME THAT HAS ALWAYS SIGNIFIED..

- √ *Top Quality*
- √ *Positive Control*
- √ *Constant Dependability*
- √ *Excellent Performance*

SUBMIT YOUR SPECIFICATIONS!

KEROTEST MANUFACTURING COMPANY
PITTSBURGH, PENNA.

WHO ELSE COULD MAKE THIS?



●*As far as we know, no one else ever forged a fitting like the one pictured above—or any welding elbow or return bend having a wall thickness so heavy in proportion to the size of the fitting.*

Such fittings simply can't be made by the processes ordinarily employed in the manufacture of welding fittings. But a special method, developed and patented by Taylor Forge, makes them "duck soup" for us . . . . An excellent example, this, of the problems that are so often put up to us by engineers who feel we are a little better qualified to solve them than any other organization.

●It isn't likely that you will ever run into a condition calling for a fitting of this kind. We simply cite such problems to show you—far better than we can tell you—how much specialized knowledge has gone into our *standard* line of WeldELLS and other Taylor Forge welding fittings.

Do not underestimate the importance of this broad experience. In WeldELLS the "know-how" acquired in solving every conceivable kind of forging problem is reflected in features that are combined in no other make of welding fittings!

A good example of this is the selective reinforcement—extra metal properly distributed where stresses are greatest. Another is the tangents; another, the final truing operation which produces those extremely accurate dimensions. These, and the other features listed opposite, give you a better job of pipe welding at lower cost. Check over the list and we believe you will agree that

WeldELLS alone combine these features:

- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

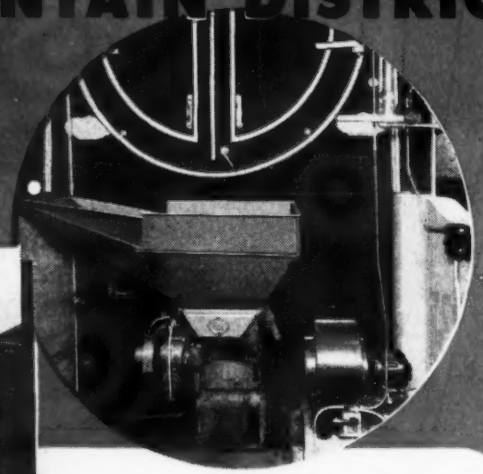
WeldELLS have everything

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

Another BROS STOKER Installation

IN THE ROCKY MOUNTAIN DISTRICT

burning low-grade Colorado coal . . .



With the bottom of the boiler only one foot above the floor, and the top against the ceiling, a 5-foot pit was made to provide combustion space. Installation effected over weekend without loss of production time.

● A Bros Super-Spred Stoker was put into the boiler room of the Brecht Candy Company of Denver. It was an important installation to the Brecht Company for this power plant supplies steam for processing and heating

Mr. A.C. Baker, general manager, writes: "Our satisfaction with Bros Super-Spred Stoker exceeds our expectation . . . Compared to our former method of firing we find a substantial saving in fuel cost . . . less than half the flyash . . . a constant available head of steam which meets all our processing and heating requirements . . . more efficient operation. You are to be complimented on your service . . . delivery was ahead of schedule"

For complete details on this efficient, economical installation write for the "Story Behind the Brecht Installation."

BROS OFFERS SINGLE RESPONSIBILITY

Wm. Bros Boiler & Mfg. Co. is an organization of engineers and manufacturers that has specialized over 60 years in the design and manufacture of boilers, stokers, tanks, and other boiler room equipment. There is a trained Bros representative near you to serve you with competent engineering service For complete information write the home office.

WM. BROS BOILER & MFG. CO.
Minneapolis 14, Minnesota

BROS Super-Spred STOKER

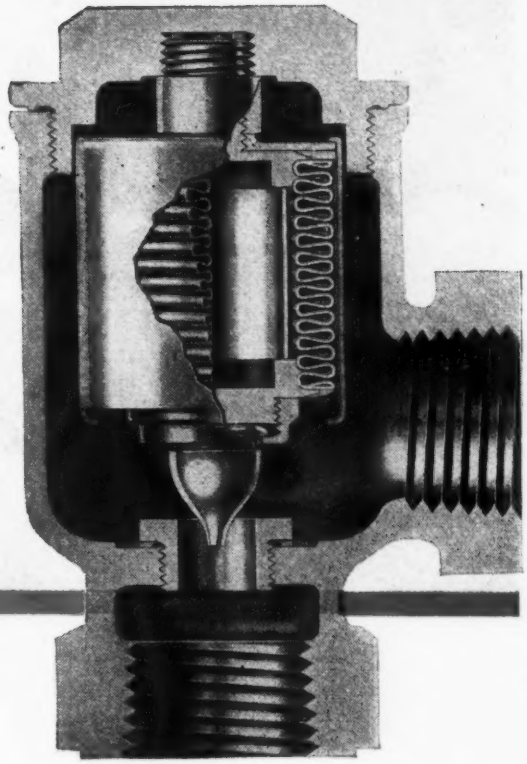
dimensional accuracy makes ⟨S⟩ worth looking for!

Years ago, Sivyer determined that Sivyer Steel Castings would merit a reputation for dimensional accuracy. Hence we go beyond usual foundry practice in checking all castings for correct size, shape and contour. Users of Sivyer Castings find this means less processing—less handling—getting castings on the job faster. That's one of the big reasons why the Sivyer ⟨S⟩ is worth looking for.

SIVYER STEEL CASTING COMPANY
MILWAUKEE ⟨S⟩ CHICAGO ⟨S⟩

ARMY E NAVY

MAKE HEAT WORK



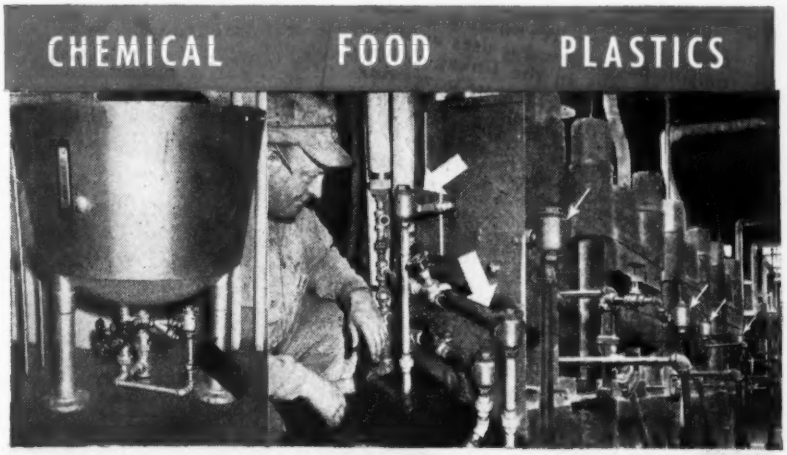
Delivery of heat units to the coils is not enough. If condensate clogs them or air is trapped in the coils, heat sits down and waits. If the wrong steam trap is used, heat will escape before its work is done.

Nor will just any trap do, because there are four kinds, each having a special function. Below we show examples of the No. 9 thermostatic trap used extensively in the heavy heat-consuming industries.

The Sarco No. 9 Steam Trap is a high pressure trap designed especially for process work. More heat is utilized before discharging condensate. The trap works over a wide range of pressures without adjustment. It is ideal for removing both air and condensate from practically all types of steam heated equipment. It is also suited to remove moisture from live steam lines.

One of these should be used on each coil. They will keep every coil alive, let no unused heat escape. Wide open when cool, they remove air instantly. They cannot stick or freeze. The No. 9 works on all pressures within its range, without seat change.

If your equipment manufacturer did not supply one for each coil, better put them on. Also ideal for air vents. Small, inexpensive, easy to install. Catalog No. 250.



Sarco No. 9's on Kettle | *Sarco No. 9's on bottle washer* | *Sarco No. 9's on plastic presses*

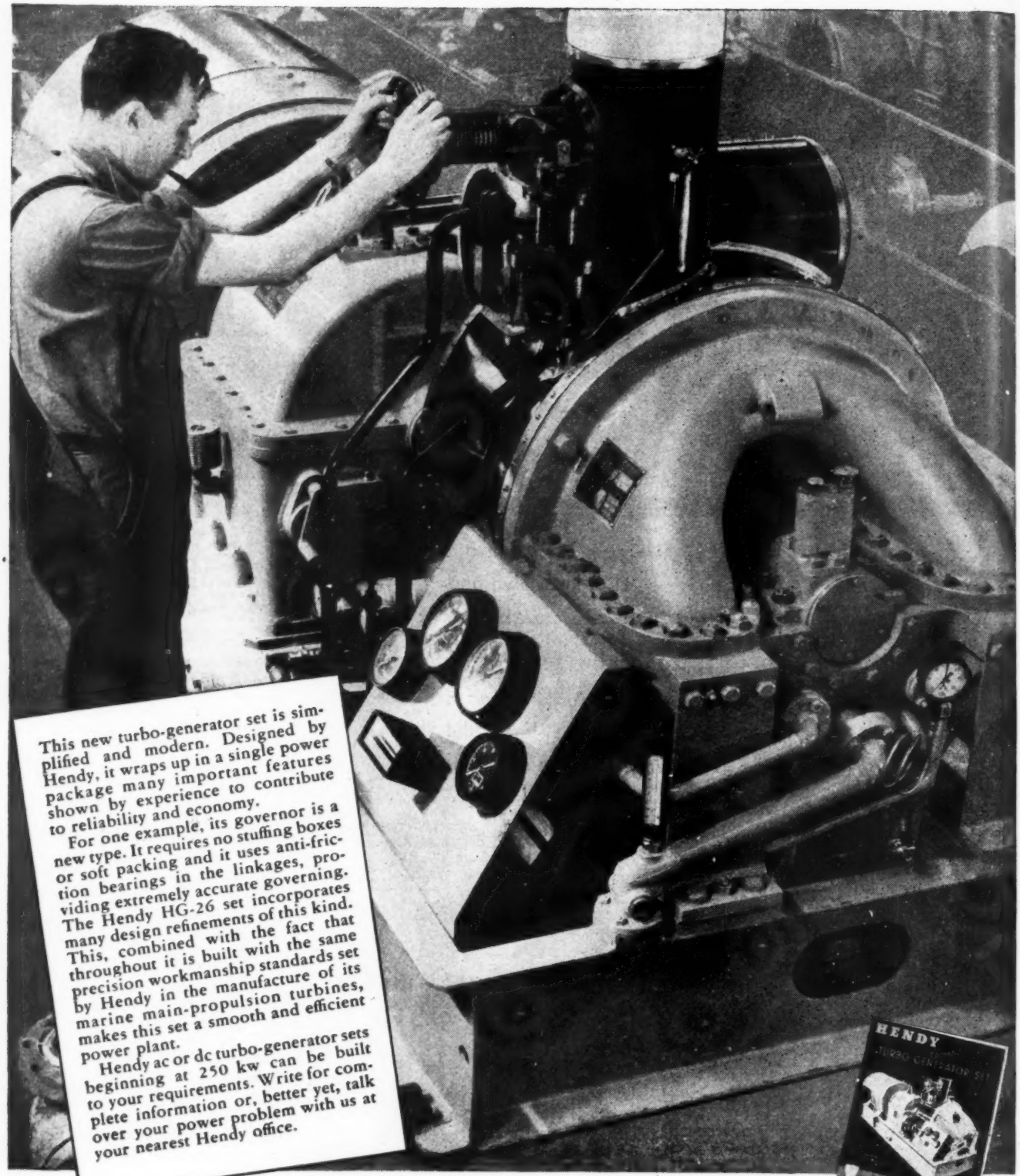
31 31

SARCO COMPANY, INC.
475 FIFTH AVENUE
NEW YORK 17, N. Y.

Represented in Principal Cities

SARCO Saves Steam

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO



This new turbo-generator set is simplified and modern. Designed by Hendy, it wraps up in a single power package many important features shown by experience to contribute to reliability and economy.

For one example, its governor is a new type. It requires no stuffing boxes or soft packing and it uses anti-friction bearings in the linkages, providing extremely accurate governing. The Hendy HG-26 set incorporates many design refinements of this kind. This, combined with the fact that throughout it is built with the same precision workmanship standards set by Hendy in the manufacture of its marine main-propulsion turbines, makes this set a smooth and efficient power plant.

Hendy ac or dc turbo-generator sets beginning at 250 kw can be built to your requirements. Write for complete information or, better yet, talk over your power problem with us at your nearest Hendy office.

JOSHUA HENDY IRON WORKS

ESTABLISHED 1856

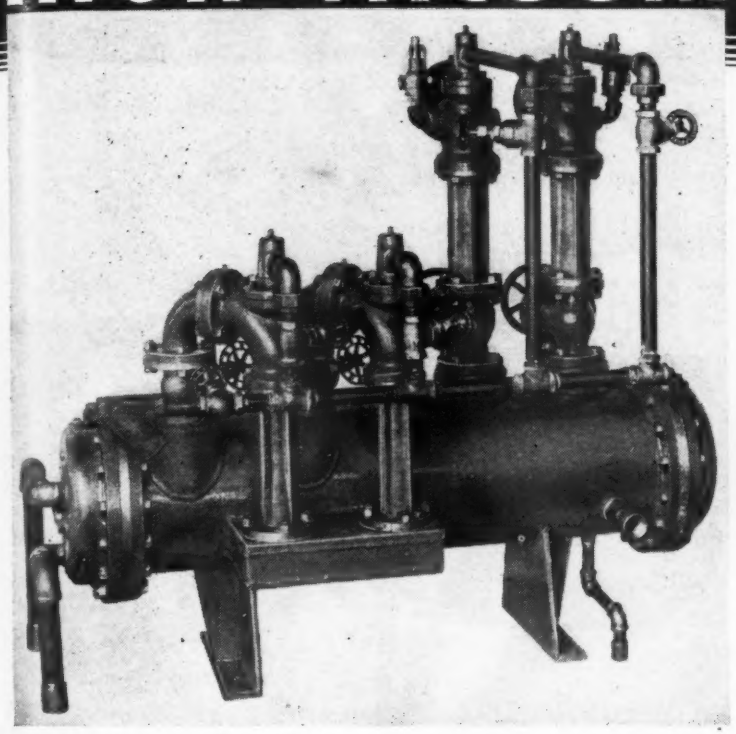
SUNNYVALE, CALIFORNIA

For complete data write for new catalog on Hendy Type HG-26 Auxiliary Turbo-Generator sets.

46-V

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • WASHINGTON • LOS ANGELES

HIGH VACUUM *at low cost*



Conseco Steam Jet Two-stage Twin-element Air Ejector. Permits continuous operation during servicing of elements.

CONSECO *Steam Jet*

Twin Element

AIR EJECTORS

For

CONDENSERS
EVAPORATORS
PRIMING PUMPS
EVACUATORS
PROCESS INDUSTRIES
DRAIN COLLECTING UNITS FOR MARINE HEATING SYSTEMS
VACUUM COOLING UNITS

Conseco Steam Jet Air Ejectors are designed to meet individual requirements, whether for new applications or for replacement of reciprocating vacuum pumps to secure lower operating and maintenance costs. Models of one or more stages are available.

The two-stage unit illustrated is recommended for most installations. It has twin elements with isolating valves and surface type inter and after condensers. The unit operates at high efficiency with only one set of elements during normal operation, and has a good capacity for starting up. Isolating valves permit removal of elements for cleaning or repair during operation. Inter and after condensers return all heat in nozzle steam to condensate from main condenser. Drains are delivered to main condenser hotwell for deaeration and collection in feed-water cycle.

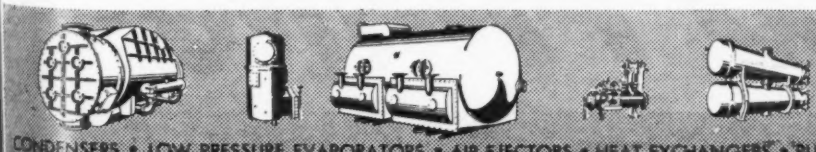
Our wide experience in servicing, repairing and replacing all types of air ejectors gives us a practical background for designing an efficient unit for your own requirements.

SERVICE

A highly skilled, specially equipped service organization, ready for immediate action anywhere on the continent, backed by engineering and manufacturing facilities producing over 3,000,000 sq. ft. of heat exchangers annually.

CONDENSER SERVICE & ENGINEERING CO., INC.

81 RIVER ST., HOBOKEN, N. J. Phone—HOboken 3-4425 After 6 P.M. or Sundays—HOboken 3-4428



CONDENSERS • LOW PRESSURE EVAPORATORS • AIR EJECTORS • HEAT EXCHANGERS • PUMPS

TUBE CLEANING GUNS AND PLUGS
AIR AND EROSION ELIMINATORS
BEVEL GEAR UNIVERSAL JOINTS
STRAINERS, GREASE EXTRACTORS
WIZARD INJECTORS, FILTERS

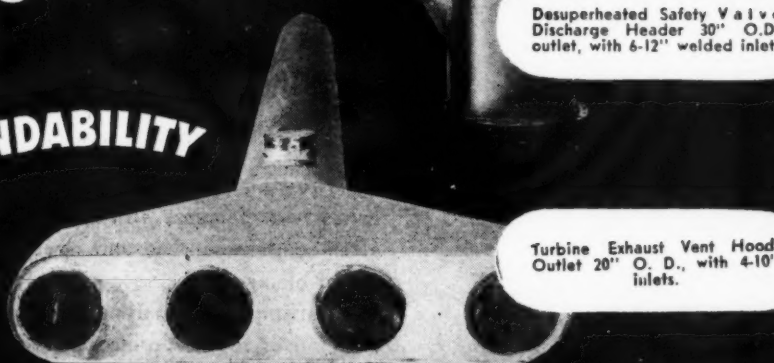
Safety Valve Piping. 42" O. D. Header with 10-12" inlet connections.

NAVCO Pre-Fabricated Piping

means

ACCURACY • DEPENDABILITY

Desuperheated Safety Valve Discharge Header 30" O.D. outlet, with 6-12" welded inlet.



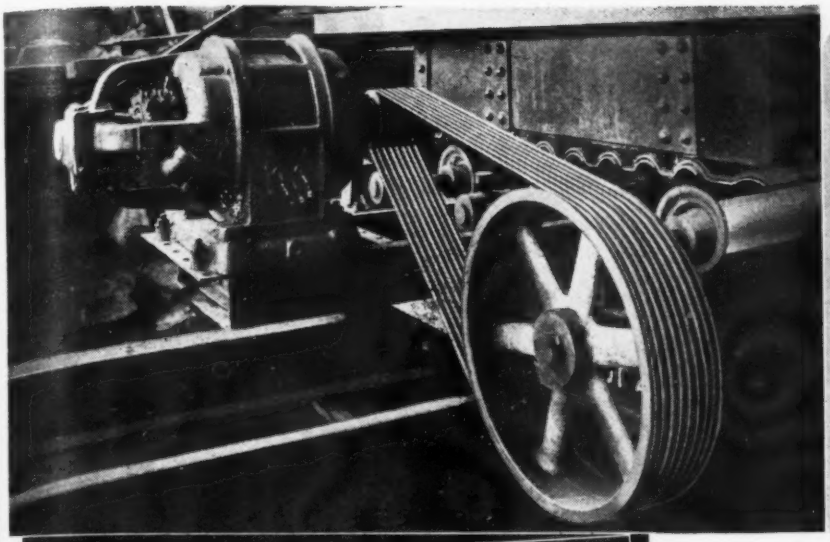
Turbine Exhaust Vent Hood. Outlet 20" O. D., with 4-10" inlets.

There are many advantages in shop fabricating such assemblies as shown here. Better control of welding is afforded — Economies are effected — Closer tolerances can be maintained. The extensive facilities of Navco Shops insure reasonable deliveries even in these days of Defense Programs and Priorities.

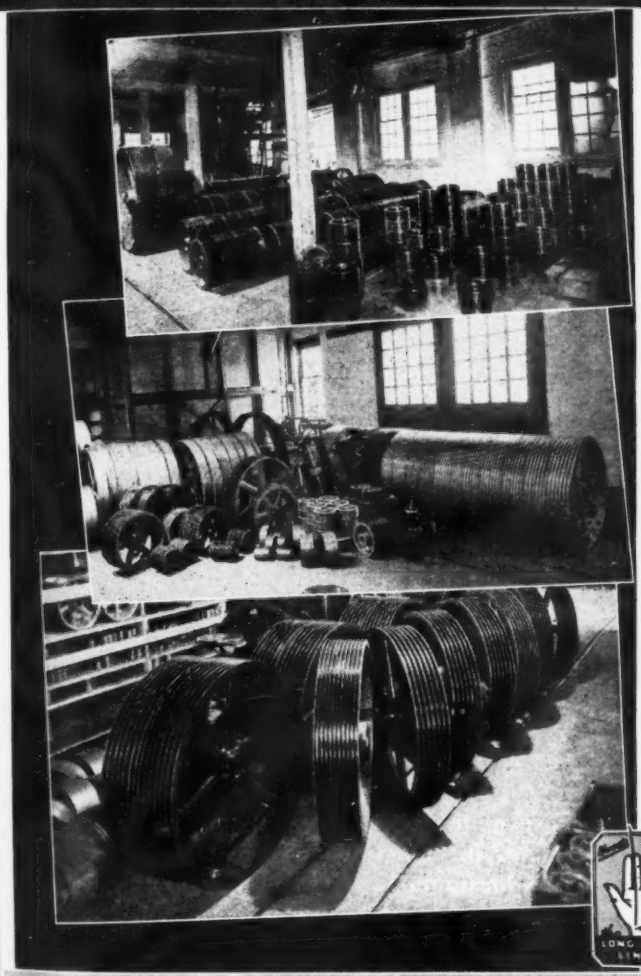
NAVCO

NATIONAL VALVE & MFG. CO.
Pittsburgh 1 Pennsylvania

NAVCO PIPING



Wood's V-BELT DRIVES



. . . ARE ENGINEERED FOR *EFFICIENT* POWER TRANSMISSION

Bringing together low speed machinery and high speed motors . . . transmitting power from its primary source to the driven machinery . . . presents a problem which can be solved effectively, with minimum loss, through the agency of V-Belt Drive.

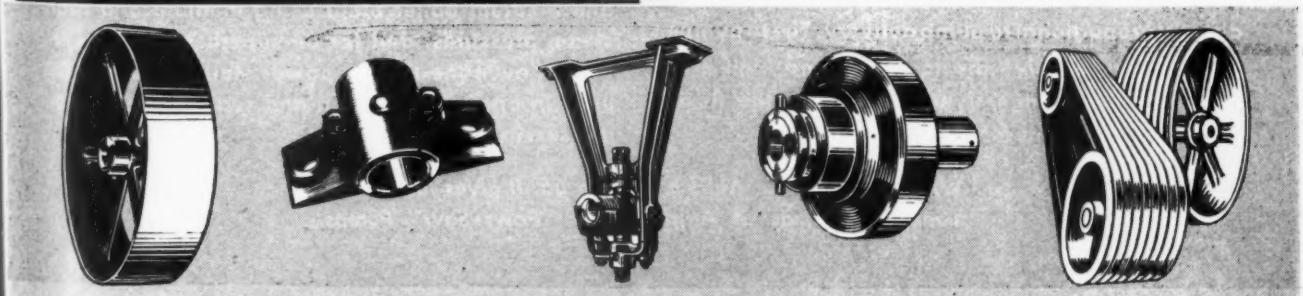
Flexible and resilient, full-molded belts in conjunction with Wood's sheaves, having precisely machined, accurately spaced, perfectly designed grooves, produce a highly efficient drive . . . the V-Belt power transmission at its maximum performance.

The benefit of Wood's pioneering experience . . . 87 years service to American industry in war and peace . . . can be yours. Wood's warehouses are adequately stocked with an assortment of sheave sizes and standard V-Belts from which we can usually take care of your needs. Special features including extra weight sheaves for fly wheel effect, bolting flanges, etc., to suit customers' requirements can be made from Wood's flexible patterns at our factory at no extra expense.

Send for our 64-page V-Belt catalog. It fully describes Wood's V-Belt Drives . . . no obligation.

EVERYTHING IN TRANSMISSION

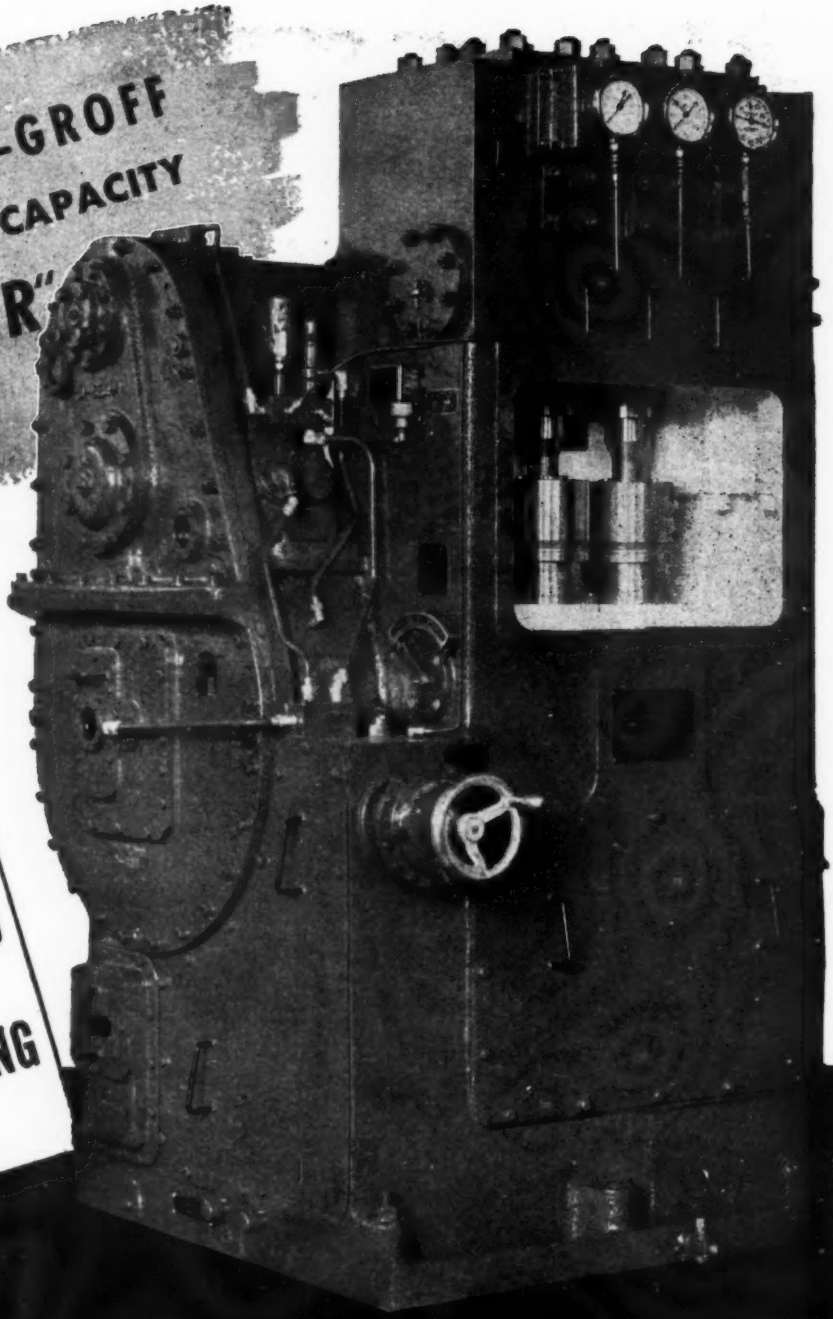
Bearings—Collars—Clutches—Couplings—Contactors —Hangers—Pillow Blocks—Pulleys—V-Belt Sheaves and Complete Drives



T. B. WOOD'S SONS COMPANY, CHAMBERSBURG, PENNA.

BRANCHES: 387-391 ATLANTIC AVE., BOSTON, MASS. • 83 PLANE ST., NEWARK, N. J. • 425 FIRST AVE., PITTSBURGH, PA.

THE ALDRICH-GROFF CONTROLLABLE CAPACITY "POWR-SAVR" PUMP . . .



. . . for MAIN BOILER FEED and DESUPERHEATING SERVICE

Aldrich-Groff Pumps provide for automatic or remote manual control of delivery, from zero to full capacity, at constant pump speed. Rate of delivery is controlled by varying the length of the plunger stroke, and power consumption is almost directly proportional to pump delivery. These pumps combine the positive displacement and high efficiency of the plunger type pump with the flexibility and smoothness of a centrifugal.

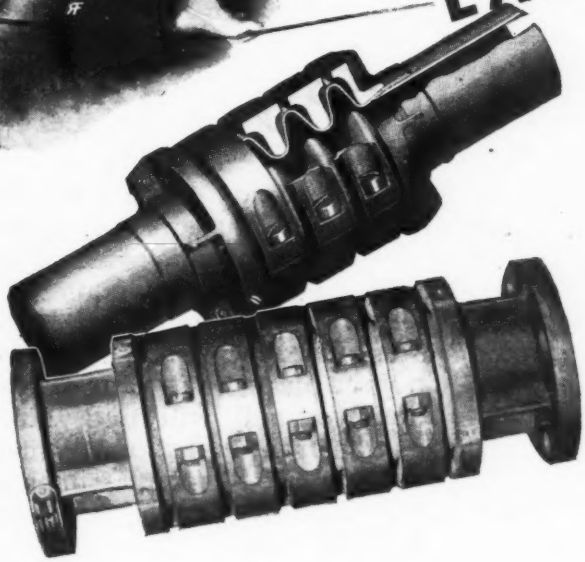
The use of these pumps with unit feed systems eliminates the pressure and power losses associated with throttling-type feed-regulating valves. They provide advantages of feed system simplicity, efficiency and mechanical reliability for the small and medium boiler plant using medium and high steam pressures, and for de-superheater feed service in even the largest power stations. Over 100 units in operation on land and sea with outstanding service records.

Write today for the Aldrich Bulletin 65. It gives full details, sizes and ratings of Aldrich-Groff "Powr-Savr" Pumps.

THE ALDRICH PUMP CO. ALLENTOWN, PENNA.

Equilibrium

Ring Controlled "PACKLESS" EXPANSION JOINTS



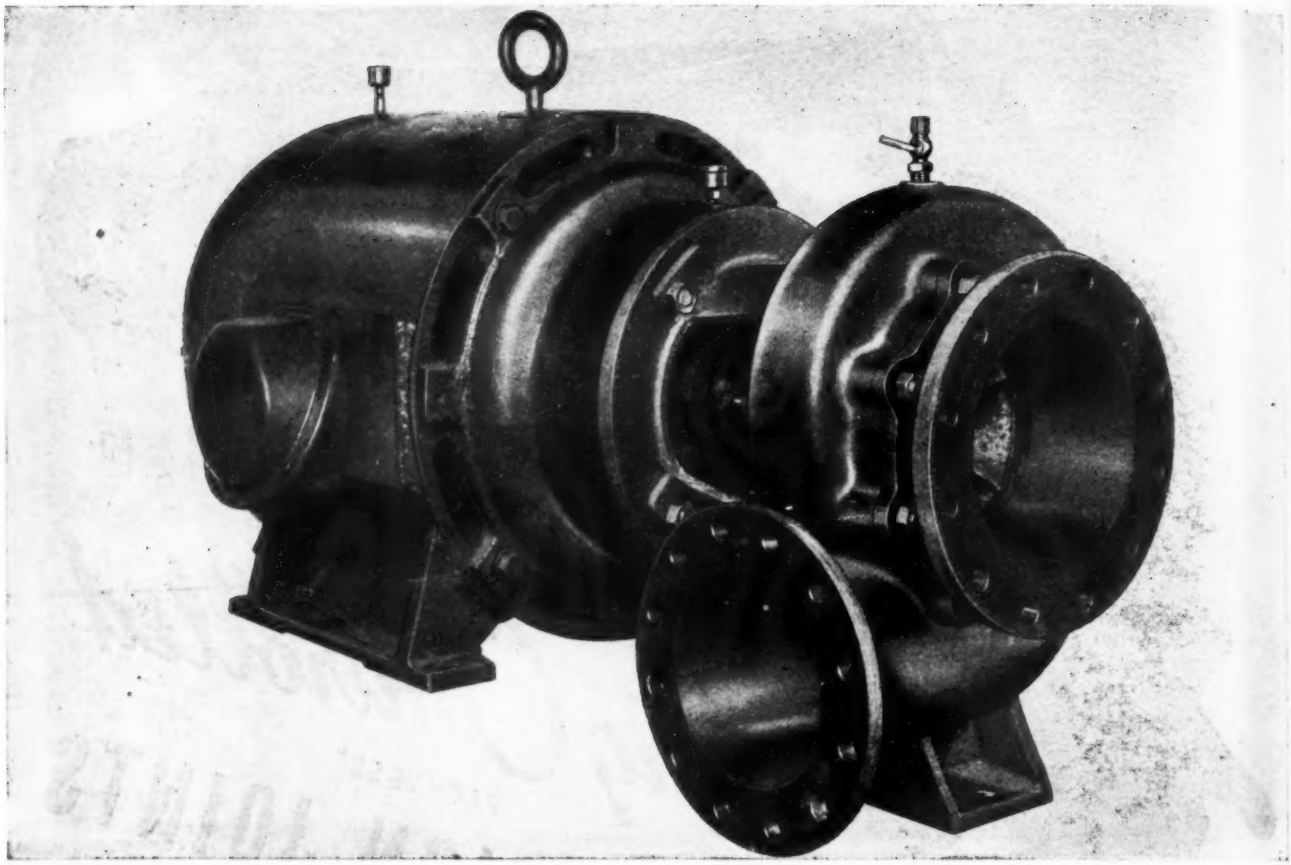
The balancing bar a circus tight rope walker carries helps to maintain equilibrium. Ring Controlled Expansion Joints as made by the Badger Fire Extinguisher Company will maintain equilibrium in a pipe line, reliably compensating for expansion due to variance in temperature, as well as vibration due to axial movement.

Ring Controlled Packless Expansion Joints, made by the Badger Fire Extinguisher Company, are available with single or multiple corrugations, in flange or weld types. Special attention is paid to the elimination of stress and strain in the metal, and there is a wide range of metals and alloys for steam, air, liquid, or gas lines, according to your need.

Catalog on request

PROCESSED IN COPPER, STAINLESS STEEL OR OTHER ALLOYS

BADGER FIRE EXTINGUISHER COMPANY *Somerville, Mass.*



EASY *to install*
ECONOMICAL *to operate*

Close-coupled pumps are usually installed in cramped quarters, or as part of a larger piece of equipment.

In either case, they are apt to get little attention, hence should be built to stay-on-the-job.

Buffalo Close-Coupled Pumps have the right hydraulic design to give high efficiency, plus the heavy-duty construction necessary for steady operation without attention. You can see, from the No. 6 Pump illustrated above, that heavy-duty construction means what it says. Buffalo Close-Coupled Pumps installed in your plant, or as part of equipment you sell, will give years of trouble free operation. Write for bulletin 975-B which gives ratings and full construction details.

ARMY E NAVY

BUFFALO PUMPS, INC.

488 Broadway Buffalo, N. Y.

Canada Pumps, Ltd., Kitchener, Ont.

"Buffalo" **Close Coupled PUMPS**

7200

MORE HORSEPOWER FOR THE ISLAND OF TRINIDAD

Here is shown one of two 3600 horsepower Nordberg Diesel engines installed in the past few years to provide additional power for the Island of Trinidad. The performance of these nine cylinder engines is typical of that of many other large Nordberg Diesels which have proved their dependability under the most severe wartime operating conditions. This is borne out by the following statement taken from a report covering a year's service of the first unit — "After approximately 6000 hours of operation, the engine was in satisfactory condition." • If your postwar plans require additional generating capacity, investigate the advantages of dependable Nordberg Diesels. They are available in capacities up to 6000 K. W. in a single unit.

Don't say DIESEL— say NORDBERG

NORDBERG MFG. COMPANY • MILWAUKEE 7, WIS.

NORDBERG MACHINERY

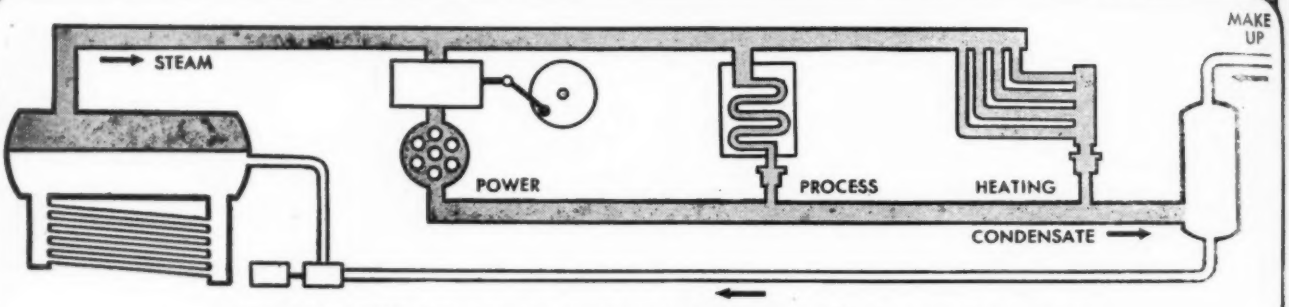
NORDBERG

DIESEL ENGINES

NORDBERG MACHINERY

Only CORAVOL★

PROTECTS THE INACCESSIBLE PARTS OF YOUR STEAM SYSTEM FROM CORROSION



The CORAVOL ZONE—indicated by the shaded area in the diagram—includes every part of a steam system not accessible to boiler feedwater treatment. It includes the boiler above the water line, steam lines, condensate return lines, radiators, valves, traps and equipment. This zone can now be reached and protected against rust and corrosive action—by CORAVOL.

Coravol FREES YOU FROM REPLACEMENTS - REPAIRS - LOST TIME COSTLY MAINTENANCE LABOR - PRODUCTION AND SERVICE LOSS DUE TO SHUTDOWNS.

The explanation is simple. For the prevention of corrosion throughout your entire steam system, Coravol completely follows the steam-condensate circuit. When fed to the steam system, it *volatilizes* with the steam, *condenses* with the steam, and dissolves in the condensate. Coravol does not remain in any one zone, but circulates throughout and protects *all* zones from corrosive attack.

The action of Coravol is two-fold. First, it prevents corrosion—thereby eliminating replacements. Second, Coravol cleans out old rust deposits resulting from previous corrosion. This cleaning action increases the effectiveness of heat transfer surfaces, restores original capacity of lines, and the operating efficiency of valves and traps.

EASY and ECONOMICAL to use. Start enjoying the time-, trouble-, and worry-saving benefits of Coravol. Write TODAY for complete data about the Coravol Process.

LINES CORAVOL BOILER

★And those products licensed for use under Western Chemical Company's basic patent.

WESTERN CHEMICAL COMPANY

715 WASHINGTON KANSAS CITY 6, MISSOURI

54 Years of Know-How In the Chemical Treatment of Water

Another box of tools?

No, Man! It's FREEDOM FROM VALVE LEAK TROUBLES

It's a Dexter Valve Reseating Outfit . . that reseats a leaky valve, *in a few minutes,* right on the line.

It's a One-Man Leak-Loss Stopper . . that saves many dollars in labor costs (no crew needed to remove old valve and install a new one).

It Reseats Every Type of Valve . . Globe, Gate or Pump, giving a clean-cut seat that's actually *better than new.*

It Saves Costly Shutdowns . . production-time-losses, manpower, and new valve costs . . as well as big money losses in steam, air, water and oil.

It's Your Opportunity to Stop Valve Leaks . . Now.

Drop us a line, giving us your valve-leak story . . . with make, type, size and material . . . whether water, air or steam, and the pressure. We'll come back with the low-cost problem-solving answer — in detail. No obligation, of course.

DEXTER VALVE RESEATING MACHINES AND CUTTERS . . . FOR GLOBE, GATE AND PUMP VALVES

17

THE LEAVITT MACHINE COMPANY
ORANGE, MASSACHUSETTS

FLEXITALLIC C-G GASKETS
for High-Pressure Flanged Joints

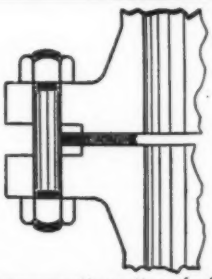
This mark stands for practices in the making of spiral-wound gaskets which have EVERYTHING to do with the safety of the joint.

The first thing you need to know about a spiral-wound gasket is whether it is *made especially for the intended operating pressure.* "Flexitallic" means that construction of the sealing member is correct for the specified service, neither too "soft" to produce a seal nor too "hard" for the bolting.

"Flexitallic" means that the manner of fastening the sealing member into the outer gauge-ring is the simplest and best arrangement. Construction employs an extension of the metal ribbon of which the spiral member is wound. The length of the extension is such that the sealing member has room to expand under compression. The spiral-wound gasket is permitted to flow outward to the ring—as it *must* for a perfect seal.

"Flexitallic" means proper pre-forming of stainless-steel ribbon so that the metal remains upright and on edge under compression and can penetrate with undiminished force into the granules of the bearing surfaces. It means a continuous central crease in the metal to permit the gasket to push, as a loaded spring, against the flanges.

Brief presentation can scarcely do justice to these points of construction. Full details are worth your effort and ours, for the result is the making of safe, lasting seals. Let us tell you what "Flexitallic" means at 150 pounds, 300 pounds, on up to 2500. Each gasket is right for the service!



Diagrammatic section of a C-G Gasket with typical Raised Face fittings showing the flanges compressed to the thickness of the solid metal member.

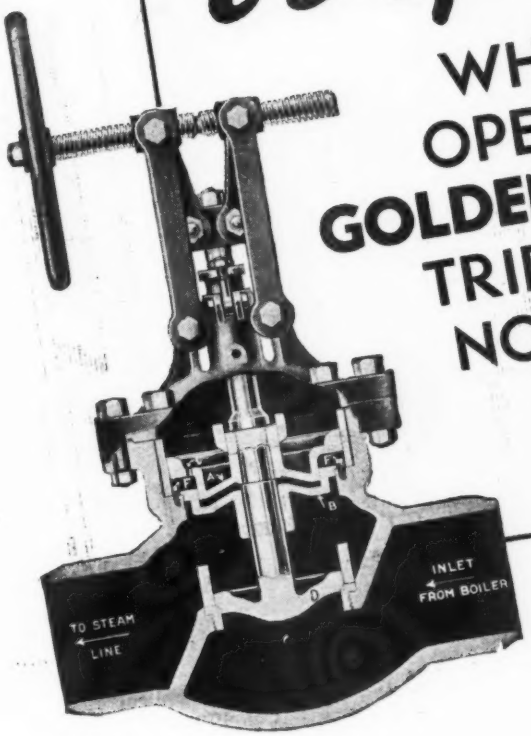
Representatives in Principal Cities

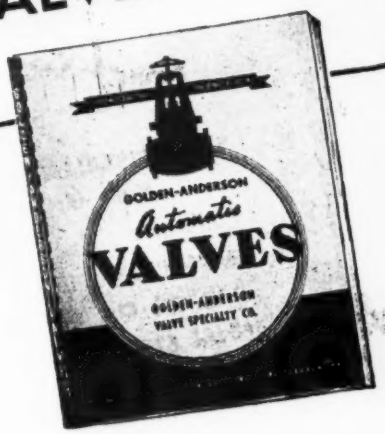
FLEXITALLIC GASKET CO., 8th and Bailey Streets, Camden, N. J.

Originators of Spiral Wound Construction

There's no chatter or spinning

WHEN YOU OPERATE THE GOLDEN-ANDERSON TRIPLE ACTING NON-RETURN VALVE!





Here is a valve that operates effectively . . . without banging, chatter or spinning . . . *under any flow conditions!* It's the "Double Corliss" dashpot assembly that does this cushioning job—and makes the GAVSCO Non-Return Valve reliable for any emergency. The design assures perfect alignment of moving parts and prevents galling or binding.

In operation the Non-Return Valve will:

1. **Automatically cut in a boiler whenever its pressure equals line-header pressure.**
2. **Isolate a boiler automatically whenever its pressure, from any cause, is lower than line-header pressure.**
3. **Prevent steam flow from boiler in event of sudden drop of line-header pressure below the boiler pressure by means of differential shot pilot valve.**

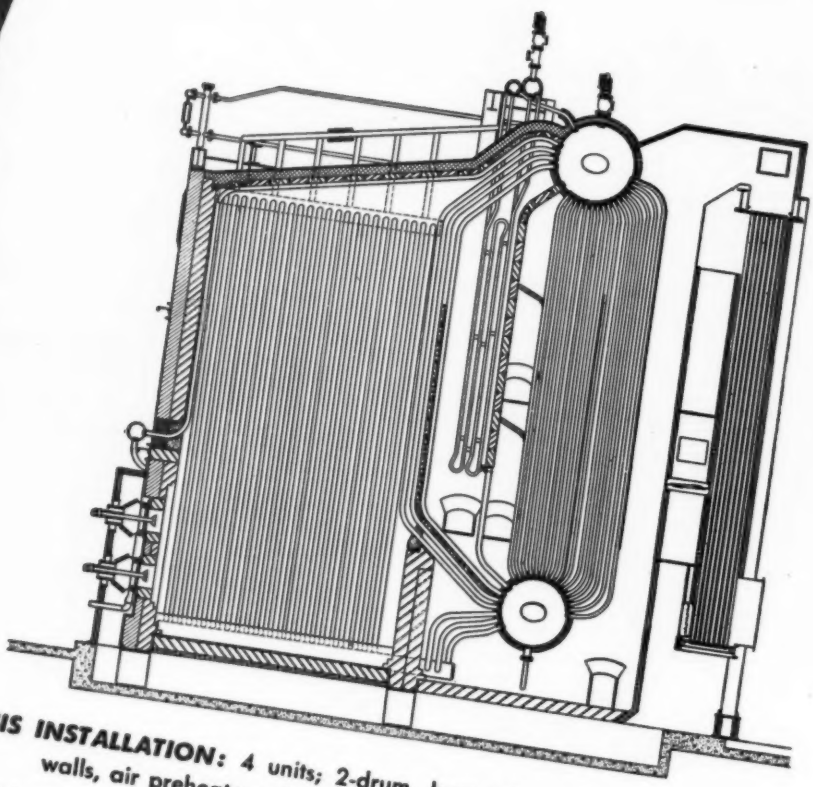
Get this unfailing, automatic life and property protection for *your* operations. The valve illustrated is a Toggle Yoke design, available in sizes from 2½" to 12", to handle 600 to 1500 lb. pressures. Other types we can supply include Angle, Globe, Elbow and Cross patterns.

This catalog contains illustrations and detailed descriptions of all GAVSCO Specialty Valves. Write for your copy today. Get acquainted with this complete line of automatic valves!

GOLDEN-ANDERSON
VALVE SPECIALTY CO.
FULTON BLDG. PITTSBURGH, PENN.

WORLD'S BEST AUTOMATIC Valves

EDGE MOOR WATER TUBE BOILERS



THIS INSTALLATION: 4 units; 2-drum, bent tube, with superheater, water walls, air preheater; oil fired.

CAPACITY . . . . . 60,000 lbs. steam per hour.

DRUM PRESSURE . . . . . 500 lbs.

DEGREES OF SUPERHEAT 233

FINAL STEAM TEMPERATURE . . . . . 700° F.

These boilers are to be used in a refinery for the production of 100 octane gasoline.

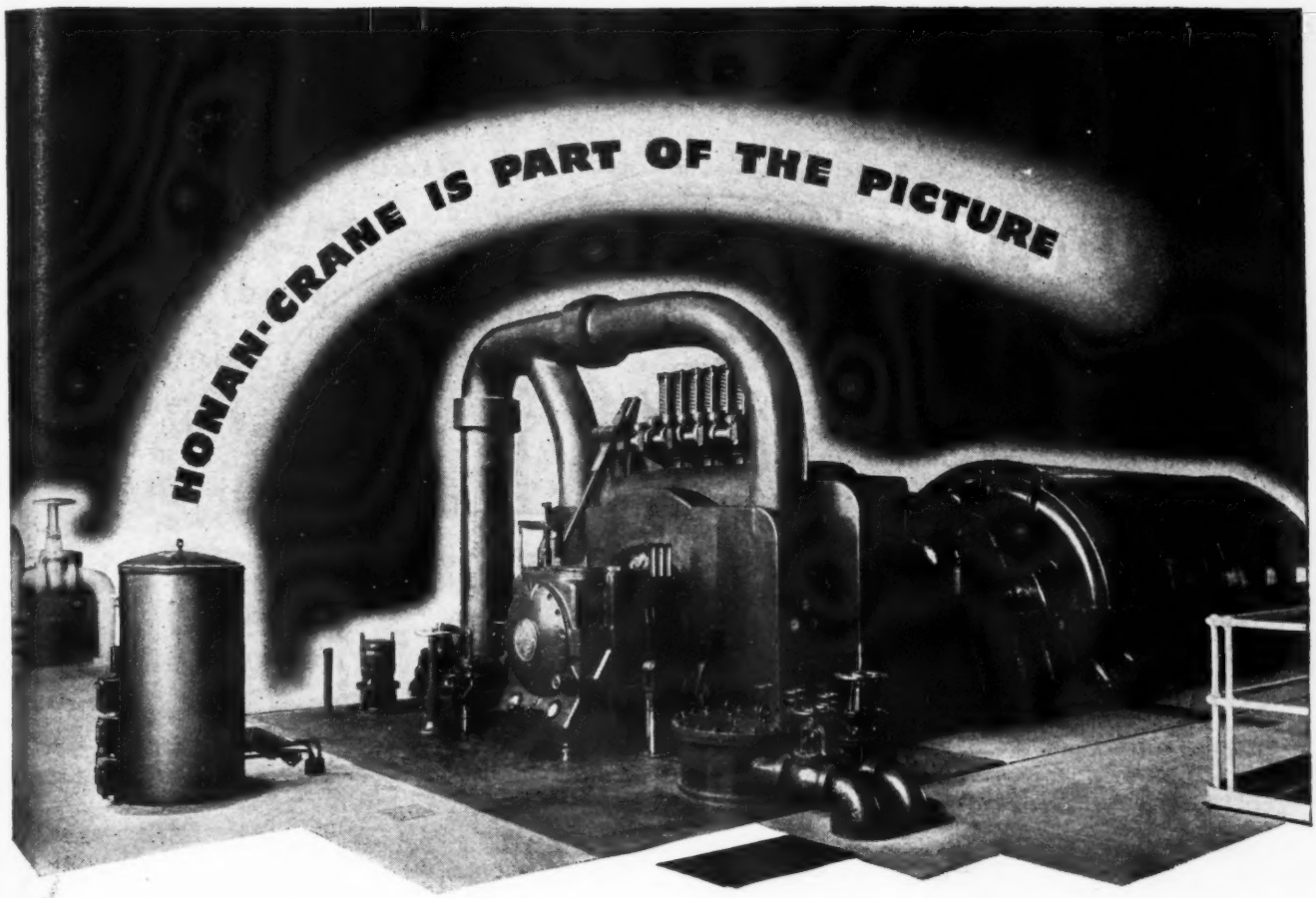
● Edge Moor Boilers are designed for any required capacity and up to 900 lbs. drum pressure. Complete steam generating units are available, including boilers, superheaters, water walls, economizers and air preheaters.

STEAM GENERATING EQUIPMENT

EDGE MOOR
IRON WORKS, INC.

BRANCH OFFICES: NEW YORK 20, N. Y.: 30 ROCKEFELLER PLAZA
CHICAGO 2, ILL.: ONE NORTH LA SALLE STREET

MAIN OFFICE: EDGE MOOR, DELAWARE



Honan-Crane "Continuous" Oil Purifiers are being installed as an integral part of the Power Equipment that is going into new plants being built today . . .

The photograph above shows a Model 30400 Honan-Crane Purifier direct connected to a 25,000 K. W. General Electric Steam Turbine that furnishes power for Lake Charles plant of the Cities Service Refining Corporation. This is one of the most complete and modern refining plants in operation today.

HONAN-CRANE SERVES MANY MAJOR OIL COMPANIES . . . . .

It is a significant fact that Honan-Crane "Continuous" Oil Purifiers are used by many of the major oil companies to purify the oil in equipment used in various operations. Some of the oil companies now using Honan-Crane Purifiers include: Cities Service Oil Company, Continental Oil Company, Gulf Refining Company, Magnolia Pipe Line Company, Phillips Petroleum Corporation, The Pure Oil Company, Socony-Vacuum Oil Company, Standard Oil of Ohio, Texas Pipe Line Company, The Texas Company.

HONAN-CRANE PURIFIERS REPLACE STRAINER TYPE EQUIPMENT

In the last few years there has been widespread recognition of the tremendous difference in the superior results obtained by thorough purification of oil as compared to the ordinary straining as accomplished by many types of oil filters. As a result of this engineering recognition there is a definite trend to replace these strainer types with the more efficient Honan-Crane "Continuous" Oil Purifiers using fuller's earth as a purifying medium.

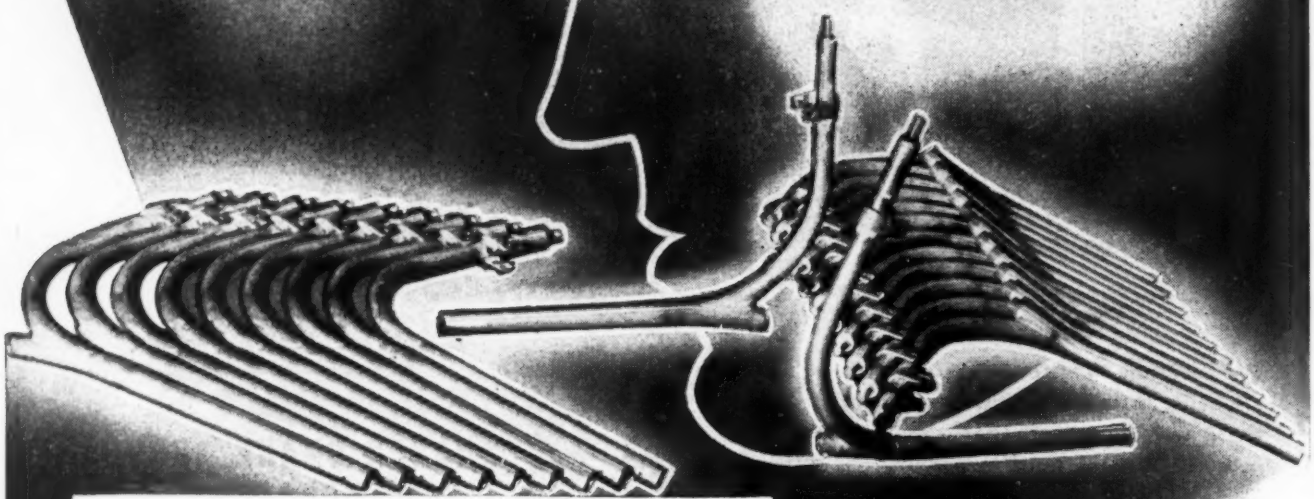
Write today for complete specifications and engineering bulletins covering the purification of lubricating and fuel oils for Diesel, Turbine, Compressor and other equipment.

HONAN-CRANE CORPORATION
1200 SIXTH AVENUE
LEBANON, INDIANA

SUBSIDIARY OF HOUDAILLE-HERSHEY CORPORATION

INSIDE VIEW OF THE BRAIN OF A FLORI-ENGINEER

Certified Welding
Close Tolerances
Precision Bending
Gauged Threading
Machine Finishing
Milling • Drilling
Brazing



Flori-Engineers are more than just blueprint readers. They understand the principles of design and the factors that influence fabrication methods. This gives Flori an "edge" in interpreting difficult or intricate piping jobs.

It is hard to realize the large amount of engineering and the many mechanical operations required to fabricate uniformly the small parts shown here.

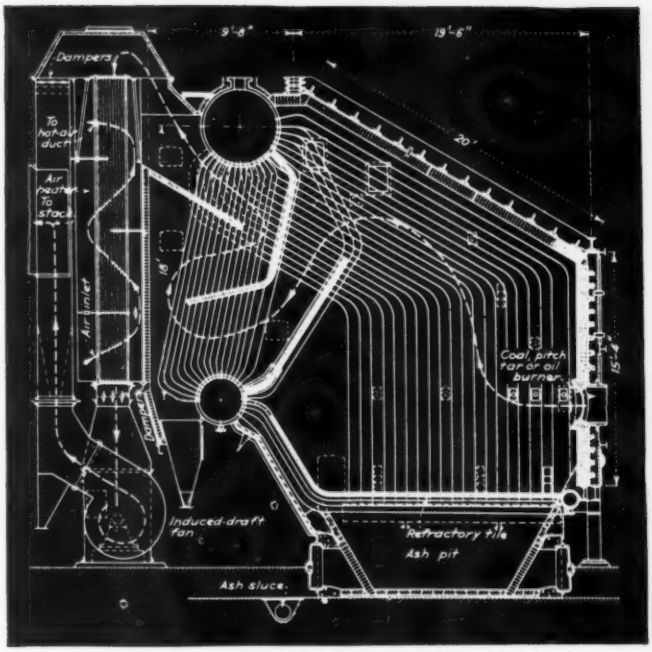
Our Engineering Department, Precision Equipment, and Modern Machine Shop are at your disposal.

IF IT'S FABRICATION—CONTACT FLORI!

THE FLORI PIPE COMPANY · ST. LOUIS · CHICAGO

REHABILITATION of INDUSTRIAL CENTER POWER PLANT RAISES EFFICIENCY TO 87%

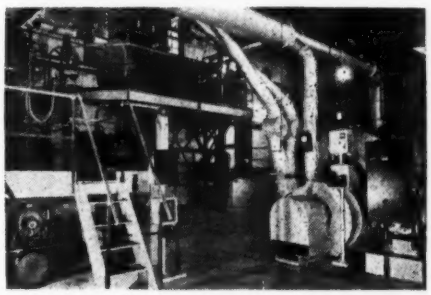
Success of Kennedy-Van Saun Steam Plant brings second and third repeat orders for complete boilers



Cross section of 80,000 lb. per hour Kennedy-Van Saun water wall steam generator. Boiler heating surface 5860 sq. ft.: water walls 1640 sq. ft.

Before modernization, the old hand fired boilers in this plant could be operated at only 45% efficiency. Replacement of some of these boilers with a Kennedy-Van Saun steam generating unit resulted in two repeat orders. A boiler and furnace efficiency of 87% was obtained as well as the ability to choose the most economical fuel, such as pulverized coal, pitch, liquid tar, oil, or low grade bituminous coal.

Equipment in this modernization program supplied by Kennedy-Van Saun included all water wall boilers, settings, breechings, air preheaters, combination pulverized coal and water cooled pitch burners, tar and oil burners, Air Swept Tube Mill for pulverizing coal or pitch, primary air fans, coal feeders, and mill level controls.



Firing platform of 80,000 lb. Kennedy-Van Saun steam generator with Air Swept Tube Mill.

Let our Engineers help you with the modernization of your boiler plant.

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVE., NEW YORK 16, N. Y.

Factories: Danville, Pa., Canada, England, Australia

THIS BOOK TELLS YOU HOW TO DO IT — MAIL COUPON

ARMY E NAVY

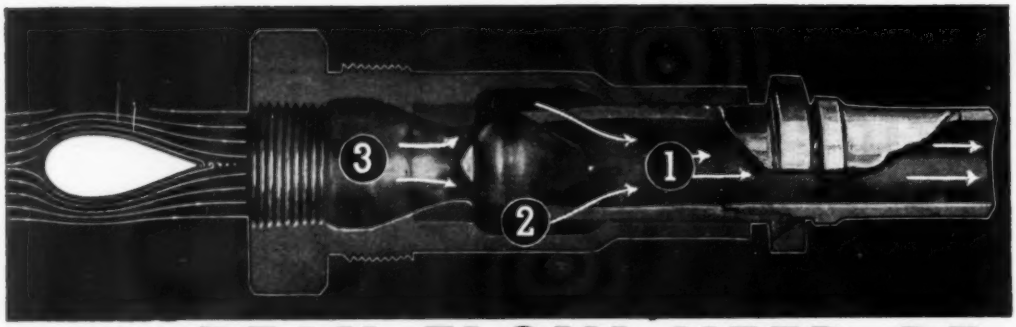
Kennedy-Van Saun Mfg. & Engr. Corp., 2 Park Ave., New York 16, N. Y.

Kindly send me Bulletin No. 12 explaining how lower grade coals can be burned efficiently:

Name ..... Position .....

Company .....

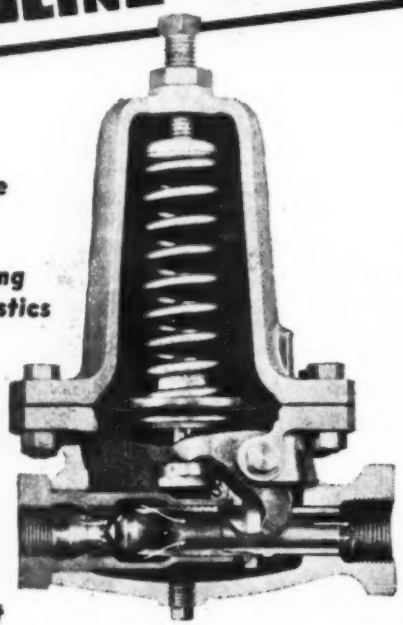
Address P-9-44



PEAK FLOW NEED BE *No Problem* . . . . AND WHY!

CASH STANDARD *Streamlined* PRESSURE REDUCING VALVES TYPE 1000

- *Extra large capacity*
- *Tight closing characteristics*
- *Close delivery pressure control*
- *Wide range of adjustment*



1. Straight Line Flow: Steam, water, air, oil, etc. — flow through this valve in a straight line — nothing is in the path of the flow to cause turbulence — therefore, peak flow is never a problem.

2. Inner valve is streamlined—no back eddies to hinder flow (see the streamlined form above)—valuable when you want all possible fluid to go through the valve to meet peak demand.

3. Turbulence eliminated by venturi approach to the valve seat. This eliminates turbulence—it means better flow. The inlet pressure is confined to a small cylindrical chamber, the same being advantageous for high pressures.

●

Write for bulletin "1000" that fully explains the cost-saving benefits that begin with the installation and last for years.

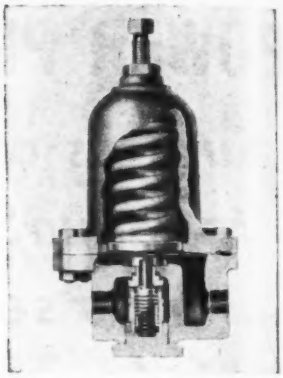
●

In giving serious consideration to the possibilities of even smoother operation in your plant, find out how this objective can easily be accomplished by installation of the "1000" valve. For example, there are no complicated parts to get out of order—no small ports or passages to clog up—no close fits. You will get much longer, lower cost service and your attention costs will be down to the absolute minimum. Day after day you will experience smooth operation, accurate regulation, elimination of failures and spoilage.

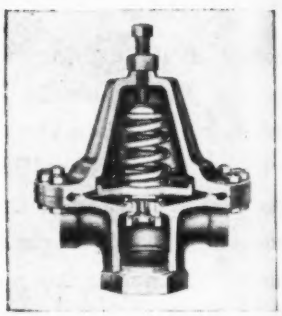
CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

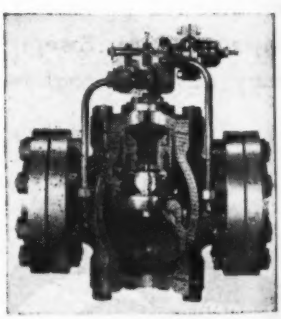
OTHER VALVES *from the* CASH STANDARD LINE



High Pressure Reducing Valve Type H-P; extra heavy for use with initial pressures up to 5000 lbs.; and for reduced pressures up to 650 lbs. Good for most fluids. Sizes: ⅜" to 2"; bronze body; nitralloy trim. Get Bulletin 931.

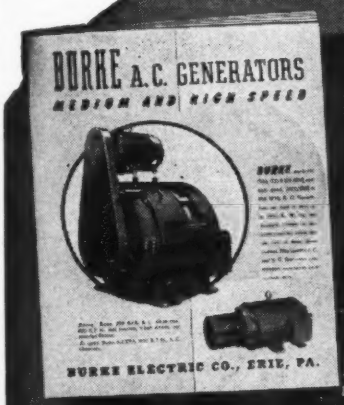


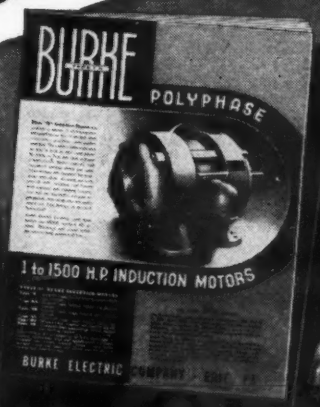
Type 8871 Pressure Regulator for dirty liquids (like Bunker C fuel oil). Inner valve is bolted to diaphragm for positive movement. Sizes ½" to 10". Bodies; iron, bronze, or steel. Seat ring and inner valve; stainless steel. Bulletin 972.

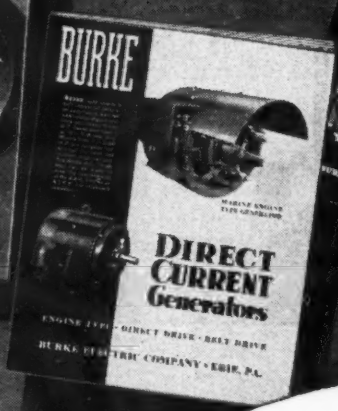


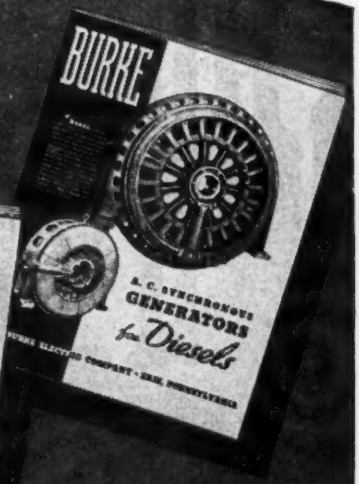
Cash Standard Type 10 Pressure Regulating Valve, pilot operated. (Pilot operating fluid discharges to outlet pipe; not wasted). Sizes: 2" to 12". Highest pressures: inlet 600 lbs.; reduced 250 lbs. Iron, bronze, or steel bodies; standard trims. For water, air, non-corrosive gases and oils. Get interesting Bulletin 966.

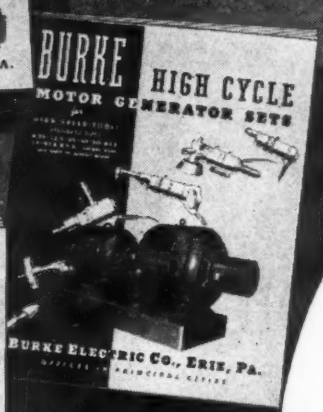
What can BURKE do for Me?

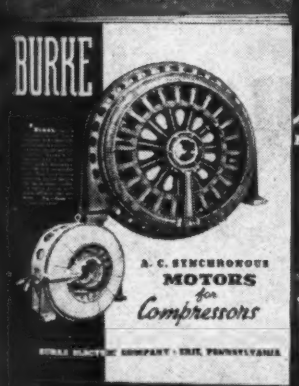


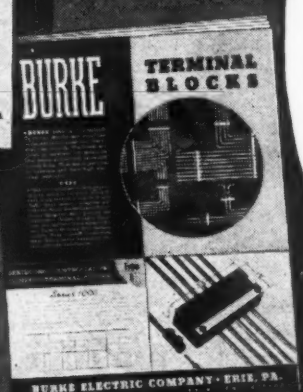






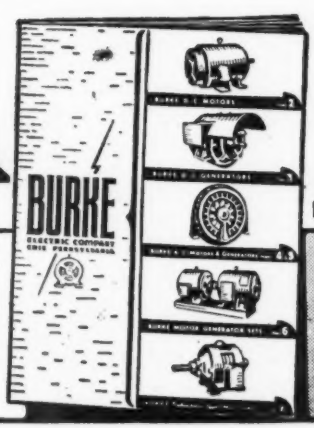






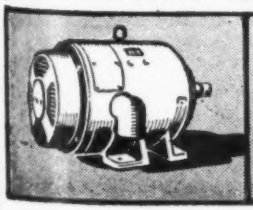
HERE'S a quick look at Burke Products to answer the headline question. When you examine each booklet, more specific questions will develop, questions that Burke engineers will be glad to answer.

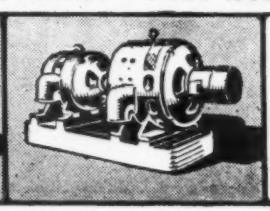
You may be surprised to learn that Burke pioneered and perfected the Universal Motor and the 3-Wire D. C. Generator, that Burke introduced the high cycle Motor Generator Set for powering High-speed Tools, and that Burke was first to use electric welding construction. In order to have you know Burke better we will be glad to send you a complete set of these Burke Bulletins.



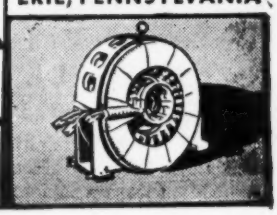
⇨ ⇨ For quick reference to the Burke line, see Sweet's Catalog File and Electrical Buyers' Reference Catalog.

BURKE ELECTRIC COMPANY • 1201 WEST 12TH STREET — ERIE, PENNSYLVANIA





D.C. Equipment to 1500 H.P. and 1000 K.W.
A.C. Equipment to 1500 H.P. and 1000 K.W.
M-G Sets to 1000 K.W.
Molded Bakelite Terminal Blocks



DOWELL INDUSTRIAL CHEMICAL CLEANING SERVICE

WHERE YOU WANT IT—

When the vital productive capacity of your power plant has been reduced by water- or steam-deposited scales and sludges, call for Dowell mobile unit service for rapid economical restoration.

WHEN YOU WANT IT!

Complete with required chemicals and scale-analysis equipment in charge of trained personnel, a Dowell unit is ready to roll to the scene at your appointed time. Correct solutions, prepared after complete analysis of the deposits, are forced by automotive pumps to all heat exchange surfaces.

This safe, effective method, involving no plant dismantling and a minimum of down-time, is a significant development of Dowell in cooperation with its parent organization, The Dow Chemical Company.

Make a date for *more power!* Get in touch with the nearest Dowell office.

DOWELL INCORPORATED

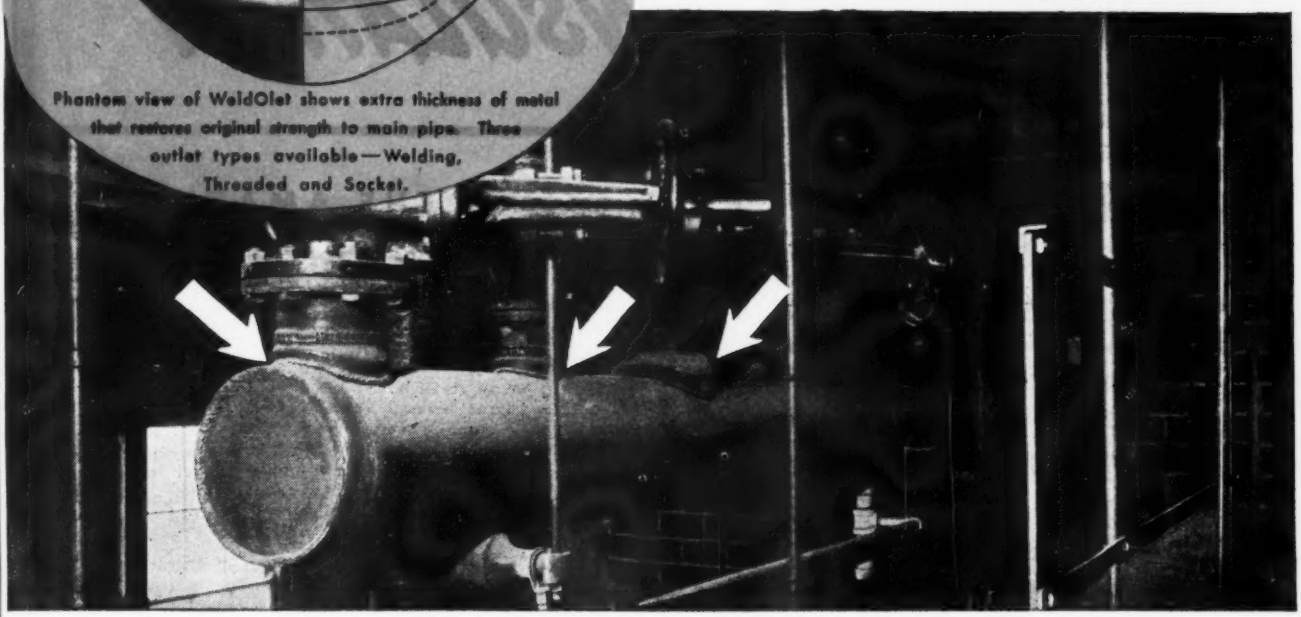
529 Kennedy Building Tulsa 3, Oklahoma

New York • Philadelphia • Cleveland • Chicago • St. Louis
Kansas City • Houston • Long Beach • Salem, Ill.
Mt. Pleasant, Mich. • Wichita, Kan. • Casper, Wyo.

Get maximum Strength where needed

by WeldOlet branch pipe method

Phantom view of WeldOlet shows extra thickness of metal that restores original strength to main pipe. Three outlet types available—Welding, Threaded and Socket.



● When pressures go up you have no difficulty maintaining a factor of safety by the WeldOlet method at least equal to that of the pipe itself.

The extra thickness and strength of the forged WeldOlet fitting will more than take care of the concentration of stress, sometimes as high as 2½ times normal stress, which is present where a branch and main come together. As a result WeldOlet branch outlets resist bending and no reinforcing or bracing is necessary. In addition the flared end of the fitting increases the efficiency of the flow materially. The result is a branch outlet by the WeldOlet method that combines highest strength with maximum flow efficiency.

Size to size and reducing sizes are available in outlets from ¼" to 12" in diameter. Ask for Catalog WT31 for full information on the WeldOlet method and data on types and sizes.

Forged Fittings Division* • BONNEY FORGE & TOOL WORKS • *342 Green St., Allentown, Pa.

WELDOLETS
TRADE MARK REG. U. S. PAT. OFF.
PAT. IN U. S. & FOREIGN COUNTRIES
WELDING OUTLET - THREADED OUTLET - SOCKET OUTLET
For Welded Branch Pipe Outlets

Castable Advantages + INSULATION

BOTH COMBINED IN KAST-O-LITE, THE AMAZING, DOUBLE-PURPOSE LIGHT WEIGHT CASTABLE REFRACTORY

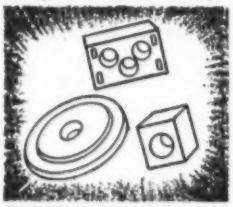
KAST-O-LITE gives you all the advantages of an efficient, dependable castable refractory — plus the economy and heat-saving advantages of insulating firebrick. Every one of these properties is combined in KAST-O-LITE, the most amazing refractory material in engineering history. Packaged ready to mix with water and install.

Engineers Such as This . . .

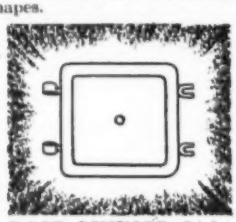
In all types of plants everywhere, engineers are praising the merits of KAST-O-LITE. Lenwell Cline, Assistant General Manager of Saginaw Foundries Company, of Saginaw, Michigan, has this to say: "The KAST-O-LITE sidewalls and arch of our 10-ton annealing furnace have proved highly satisfactory from the standpoint of ease of installation and refractory service. "After four years of operation, this KAST-O-LITE lining appears to be as good as the day it was installed."

Wide Range of Uses

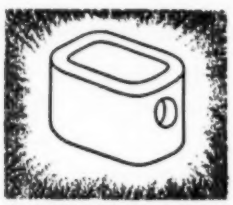
Because KAST-O-LITE is not only a castable — or just an insulation — but a dependable combination of both — it offers a wide range of uses. Wherever insulating refractory properties are desired, KAST-O-LITE offers construction advantages and economy. For complete linings, walls, arches or special shapes.



SPECIAL SHAPES: Odd and intricate shapes possessing the economy advantages of insulating firebrick can be easily and quickly cast in your own plant with KAST-O-LITE.



DOOR LININGS: Light weight and insulating properties make KAST-O-LITE ideal for door linings. Protects door casting from warpage. Easily cast into place.



COMBUSTION CHAMBERS: Your chambers can be cast easily with KAST-O-LITE. Insulating properties allow operating temperatures to be reached quicker. Resist thermal shock.

Cuts Fuel Bills!

SAVES—REDUCES HEAT LOSSES

The light weight and composition of KAST-O-LITE means that less heat is lost through the lining. Thermal conductivity as used is only approximately 30% that of heavy firebrick. This denotes that 9" of KAST-O-LITE (the normal thickness of a furnace lining) is equal to 27" of firebrick in insulating value. Closer temperature control is possible. Fuel savings result.

For Use up to 2500° F. —in direct contact with flame

KAST-O-LITE combines insulating properties with strength and all the advantages of convenient mix-and-pour refractories for use up to 2500° F. in direct contact with flame.

Quick Delivery— Local Stocks & Service

Warehouse stocks of KAST-O-LITE are located near you for prompt delivery. Look in the classified section of your local telephone directory for the name of your nearest A. P. Green representative. He'll be glad to show you more about the advantages of KAST-O-LITE.

U. S. MARITIME "M" FOR PRODUCTION ACHIEVEMENT

A. P. GREEN FIREBRICK COMPANY

A. P. GREEN — the First Name in Refractories

MEXICO, MISSOURI

KAST-O-LITE
INSULATING CASTABLE REFRACTORY

HERE'S an opportunity to cut operating costs . . . Find out exactly how you can save fuel with a Honeywell Zone Control System. A nationwide survey of Honeywell Zone Control installations reveals an average fuel saving of more than 20 per cent . . . This equipment is available for installation now, and, in addition to saving fuel, enables you to maintain the exact temperature you require in each "zone" or area in your building. A Honeywell engineer will determine the fuel saving possibilities in your plant or building. Just telephone the Minneapolis-Honeywell office in your city, or send coupon today. There is no expense or obligation. Engineers are available anywhere in the U. S.

MINNEAPOLIS
Honeywell
CONTROL SYSTEMS

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
2702 Fourth Avenue South, Minneapolis 8, Minnesota

We would like to determine the fuel saving possibilities of a Honeywell Zone Control System. Please have your engineers call.

Name.....

Firm.....

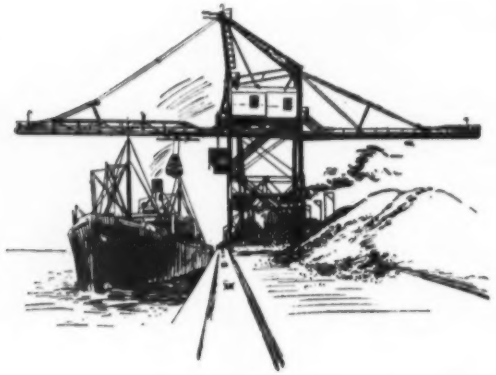
Address.....

City.....State.....

羅 並 施

RO - B - INS

In Chinese, RO-B-INS literally means "collect and deliver". In France, any Belt Conveyor is called a "Robins Carrier". In the Arctic Circle, the only mechanical means of handling coal is with a Robins Coal Handling System.



So it goes, all over the world—"Robins Conveyors" is synonymous with efficiency, speed, economy in the handling of heavy, bulk materials. The logic of this fact is obvious: so many inventions in this field emanated from Robins—starting 'way back in 1891 when Thomas Robins first created the rubber-covered Conveying Belt and the trough-shaped Idler, and continuing through the present when new names have to be coined for machinery conceived especially to meet the particular needs of a specific plant.

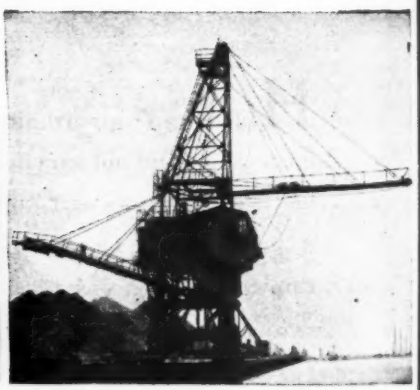
Wherever bulk-cargo vessels must be unloaded quickly, you will find Robins-Mead Morrison Towers taking several grab-loads a minute—or the boats discharging their own cargo with Robins Self-Unloader mechanisms. Where huge stockpiles must be built and reclaimed, you will find Robins Man Trolley or Rope System Bridges. Where speed of unloading freight gondolas is wanted—with minimum degradation of fragile or friable substances—you will find Robins Car Dumpers unloading them as quickly as 60 seconds per car.

Wherever there is any problem in the conveying, hoisting, storing, crushing, sizing and distributing of coal, coke, aggregates, ore, chemicals or other bulk materials—in quantity—Robins Conveyors has a sure solution. Its engineering ingenuity and manufacturing skill have increased efficiency and reduced costs for all types of concerns in all parts of the world.

Perhaps you face a need now. Consultation with an engineer from the nearest of our ten offices is yours for the asking—free of cost or obligation. Please address Dept. P-9 when inviting his call.

Car Dumpers

Coal and Ore Bridges



Loading and Unloading Towers

Bulletin 121-P-9 describing Robins-Mead Morrison Machinery for handling bulk materials in quantity, is available on request.

ENGINEERS • MANUFACTURERS • ERECTORS

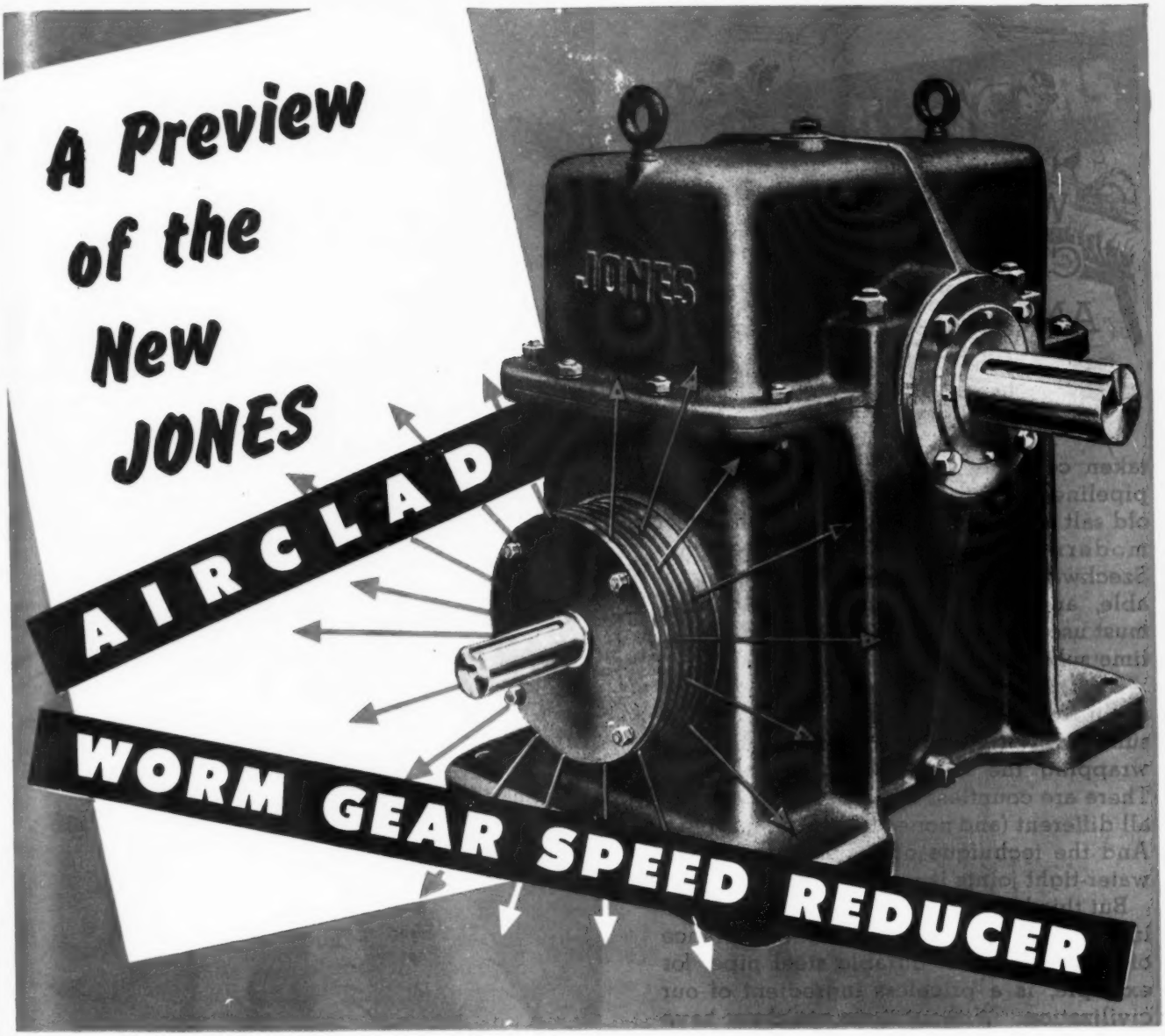
ROBINS CONVEYORS
INCORPORATED
Founded in 1896 as Robins Conveying Belt Co.
PASSAIC • NEW JERSEY

ROBINS *makes:* BELT CONVEYORS • COAL AND ORE BRIDGES • BUCKET ELEVATORS • CAR AND BARGE HAULS • CAR DUMPERS • CAR RETARDERS • CASTINGS • CHUTES • CONVEYOR IDLERS AND PULLEYS • CRUSHERS • FEEDERS • FOUNDRY SHAKEOUTS • GATES • GEARS • GRAB BUCKETS • PIVOTED BUCKET CONVEYORS • VIBRATING SCREENS • SCREEN CLOTH • SELF-UNLOADING BOAT MECHANISMS • SKIP HOISTS • STORAGE AND RECLAIMING MACHINES AND SYSTEMS • TAKEUPS • LOADING AND UNLOADING TOWERS • TRIPPERS • WEIGH LARRIES • WINCHES • WINDLASSES

FOR MATERIAL AID IN MATERIALS HANDLING . . . . . It's ROBINS

MATERIALS HANDLING MACHINERY

A Preview of the New JONES AIRCLAD WORM GEAR SPEED REDUCER



DURING the exigencies of the past several years our major effort has been the production of gears and speed reducers for the war effort. In the production of essential materials we have a commendable record of service.

Notwithstanding the pressure of war work, our engineers have been able to devote some time to the development of an improved type of air cooled worm gear speed reducer. This new machine has remarkable capacity for increased ratings, under continuous operation in the higher range of motor speeds, when compared with the conventional type of unit.

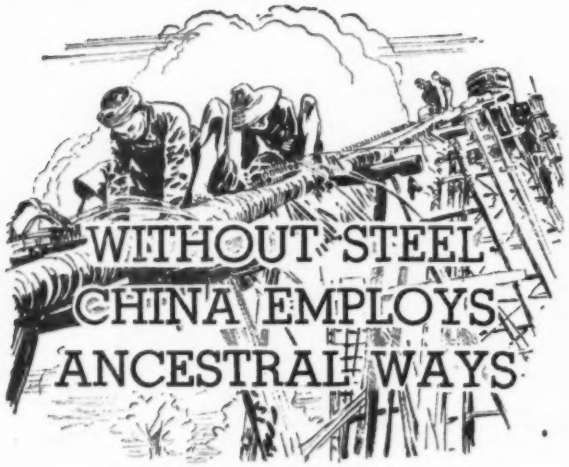
We are making this preliminary announcement because the benefits to be gained by the use of the Jones AIRCLAD units will have a marked effect on worm gear speed reducer practice and the industrial application of drives in the future.

Complete catalog information is not ready for distribution at this time. However, as soon as conditions permit of our making this fan-cooled reducer commercially available, industry will be offered a product that is second to none in design, construction and dependability—a reducer that will be a worthy addition to the line of time-proven Jones products.

W. A. JONES FOUNDRY & MACHINE CO., 4423 Roosevelt Rd., Chicago 24, Illinois

Jones

HERRINGBONE — WORM — SPUR — GEAR SPEED REDUCERS
PULLEYS • GEARS • V-BELT SHEAVES • ANTI-FRICTION
PILLOW BLOCKS • FRICTION CLUTCHES • FLEXIBLE COUPLINGS



WITHOUT STEEL CHINA EMPLOYS ANCESTRAL WAYS

THIS picture might have been taken centuries ago. It shows a bamboo pipeline, carrying brine from 2,600 year old salt mines to a refinery in the heart of modern China. Here in Tse Liu Ching, Szechwan province, steel pipe is not available, and the Generalissimo's engineers must use primitive bamboo pipe as a wartime substitute.

Of course the bamboo pipe splits, is eaten by insects, deteriorates with age and sun. Every day coolies must repair it, by wrapping the lines with bamboo strips. There are countless sizes of bamboo pipe, all different (and none of them big enough). And the technique of making permanent water-tight joints is unknown.

But this bamboo pipe points to what we in America seldom realize..the importance of steel. Low-cost durable steel pipe, for example, is a priceless ingredient of our civilization. Without it we could not have our pure water supplies, or our sanitary systems. Our railroads, factories, oil fields and power plants could not exist without modern steel pipe.

Steel is America's No. 1 basic industry. The whole structure of American life--with all its security, convenience and comfort--depends upon the steel and steel products of which Youngstown is a leading manufacturer.

QUALITY
TRADE MARK
YOUNGSTOWN
SERVICE

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Ask your distributor for Youngstown

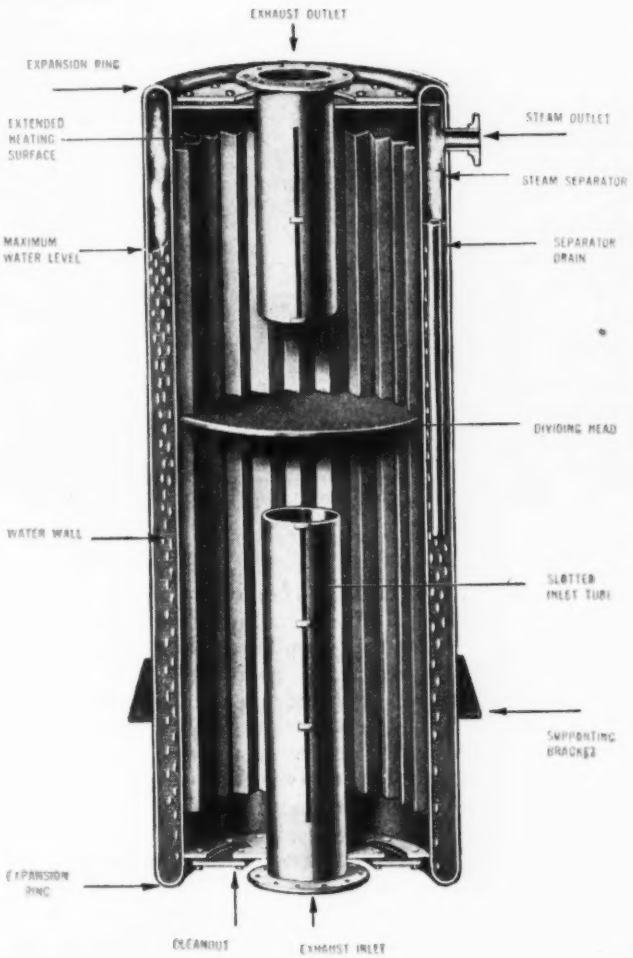
Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Electrolytic Tin Plate - Coke Tin Plate - Rods - Wire - Nails - Tie Plates and Spikes - Alloy and Yoloy Steels.

SAVE... WITH MAXIM HEAT-RECOVERY SILENCERS ....FUEL

The source of heat used by Maxim Heat Recovery Silencers is engine exhaust heat, normally wasted. From this heat and hence without the use of any additional fuel, steam or hot water for heating or processing operations is developed in practical usable volume. In addition, effective silencing of exhaust noise is accomplished (with or without the spark arrestor feature).

From an efficiency point of view the use of Maxim Heat Recovery Silencers is good practice at any time. From a national fuel conservation point of view their use is more than ever indicated today.

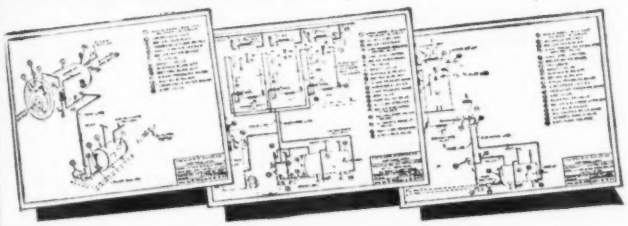
Why not present your specific problem to Maxim engineers? Descriptive Bulletins WH-100, WH-102 and WH-103 will be sent promptly on request.



★ ★ ★ ★ ★ ★ ★ ★ ★

Maxim Silencers without the heat recovery feature are available for effective silencing of internal combustion engine exhaust or intake, steam engine exhaust, air compressor intake, vacuum pump discharge, blower intake and discharge. Engine exhaust silencers available with or without spark arrestor. Bulletins on request.

TYPICAL HOOK-UPS



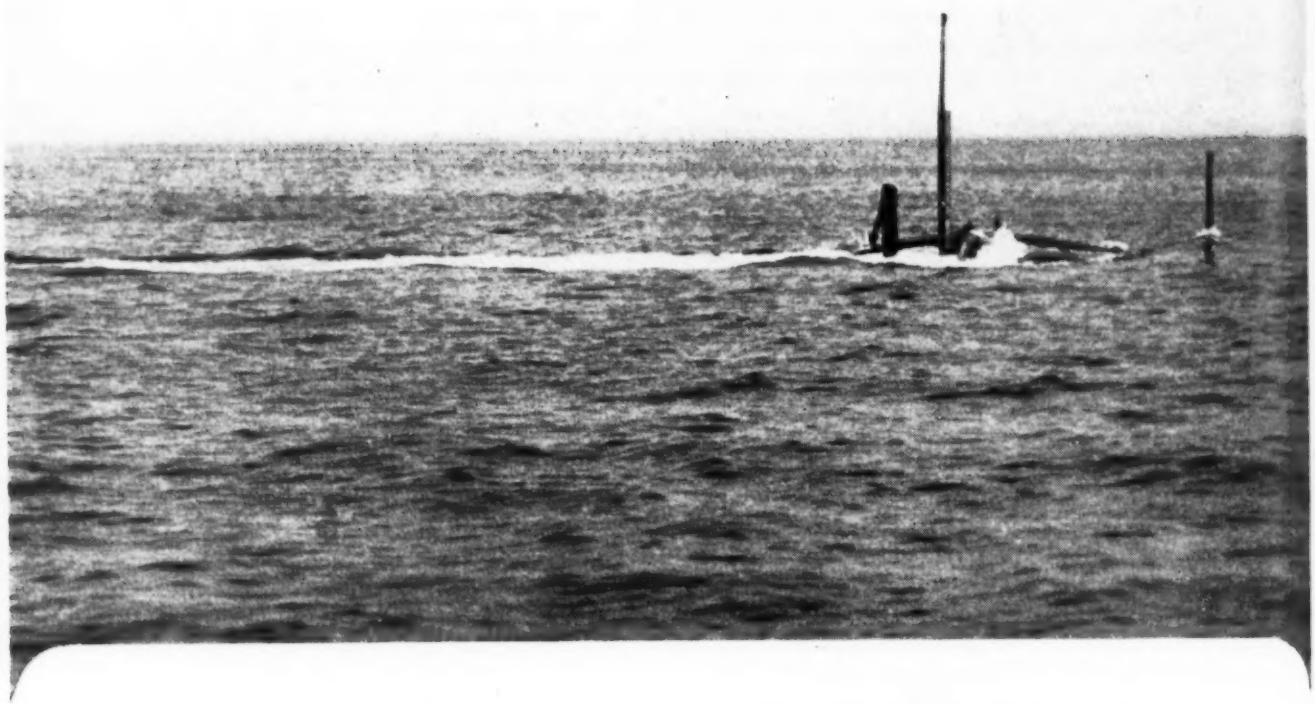
The Maxim Engineering Department has prepared several drawings of typical Heat Recovery Silencer hook-ups. These are available with a detailed discussion of each hook-up. We will be glad to send them to you. Simply ask for Dwgs. B-298, B-301, B-302 and B-303.

THE MAXIM SILENCER CO.
92 Homestead Ave., Hartford, Conn.

ARMY E NAVY

MAXIM

HIDDEN *Water Hazards*



● Hidden Hazards . . . sponsored by Uncle Sam . . . are showing up in many waters with devastating results for the enemy.

Hidden Hazards . . . sponsored by Objectionable Dissolved Minerals or Chemical Instability . . . are showing up in many water supplies with just as devastating results for plant equipment and manufacturing processes.

In the latter case action is far from spectacular . . . that's why the Hazards are Hidden . . . but, in either case . . . the end results are the same.

Water that is conditioned to remove objectionable minerals, hardness, corrosion, oil, suspended matter, etc. will protect your production schedules, safeguard irreplaceable power plant equipment, save precious fuel and reduce labor costs.

The power plant, so vital to the war effort, can have the protection of Infilco equipment for boiler or evaporator feedwater treatment, cooling water conditioning, condensate oil removal, steam purification, etc. . . . as well as Infilco chemical feeders and trade waste treating equipment. You are invited to make use of Infilco's 49 years' experience in these allied fields. Call on our Engineering Staff. There is no obligation.

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325 W. 25TH PLACE, CHICAGO 16, ILL.

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ACCELATOR SOFTENERS • CHEMICAL FEEDERS • PROPORTIONERS
WATER FILTERS • CLARIFIERS • COOLING WATER CONDITIONERS
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LIME-SODA SOFTENERS • ZEOLITE SOFTENERS • CATEXERS

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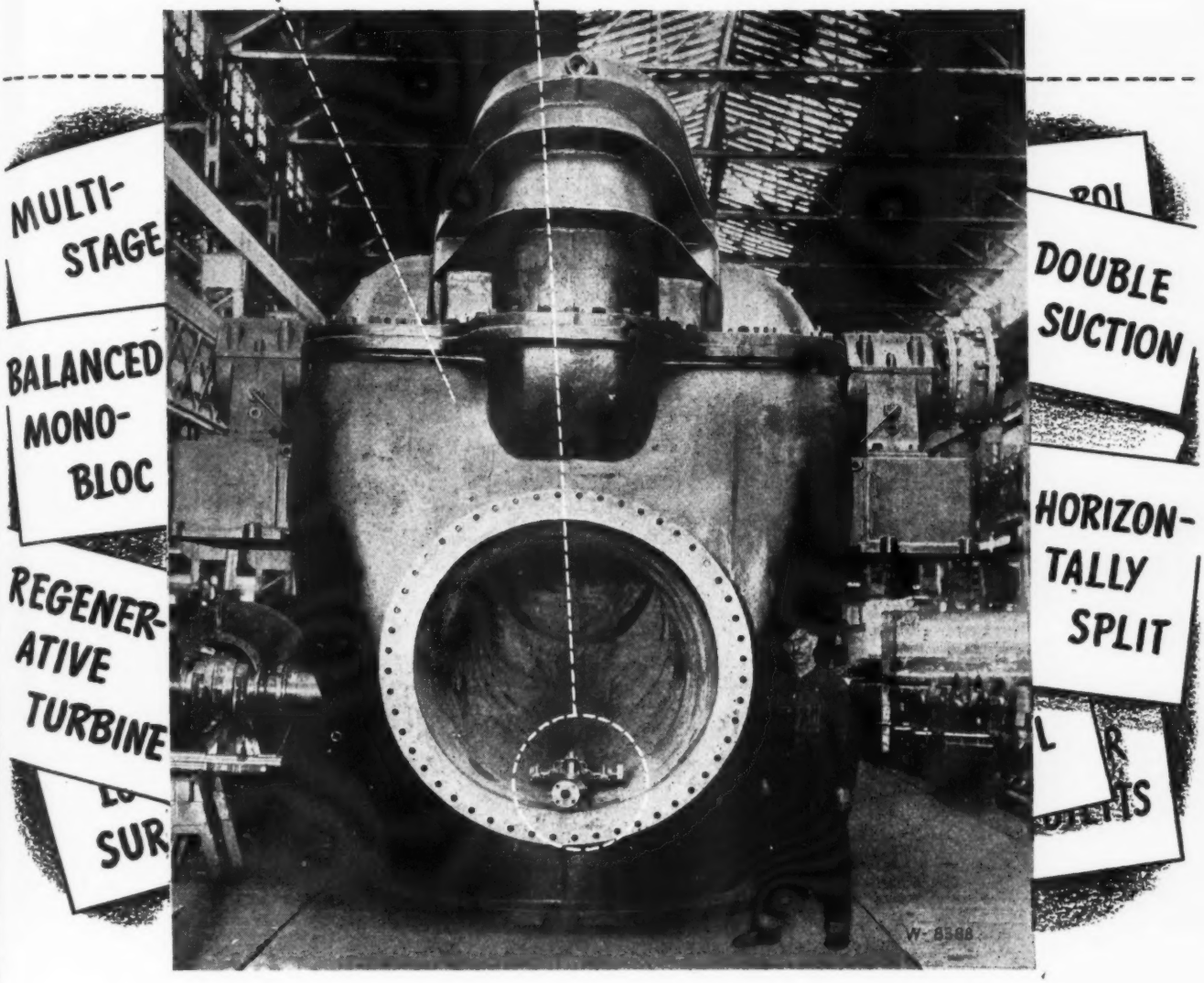
FROM GIANT TO MIDGET . . *Worthington builds 'em all*



The giant 66" Worthington centrifugal pump, holding the midget of the family in its massive discharge, well illustrates the complete scope of Worthington's line of standard centrifugal pumps available for your needs.

This particular big Volute Type LC pumps 135,000 g.p.m., more than 1500 times as much as the little Type R of similar design.

But, big or small, *all* Worthington standard centrifugal pumps share these two reasons for success:

1. The dependability and fitness for their service built into them by the world's largest pump manufacturer.
2. The progressive design features and high quality necessarily maintained by a firm which, like Worthington, also manufactures all kinds of specially engineered centrifugal process pumps for all industries.

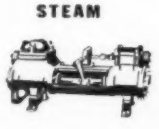
WORTHINGTON *BEHIND THE NAME* WORTHINGTON

For information, write us, or call our nearest district office.

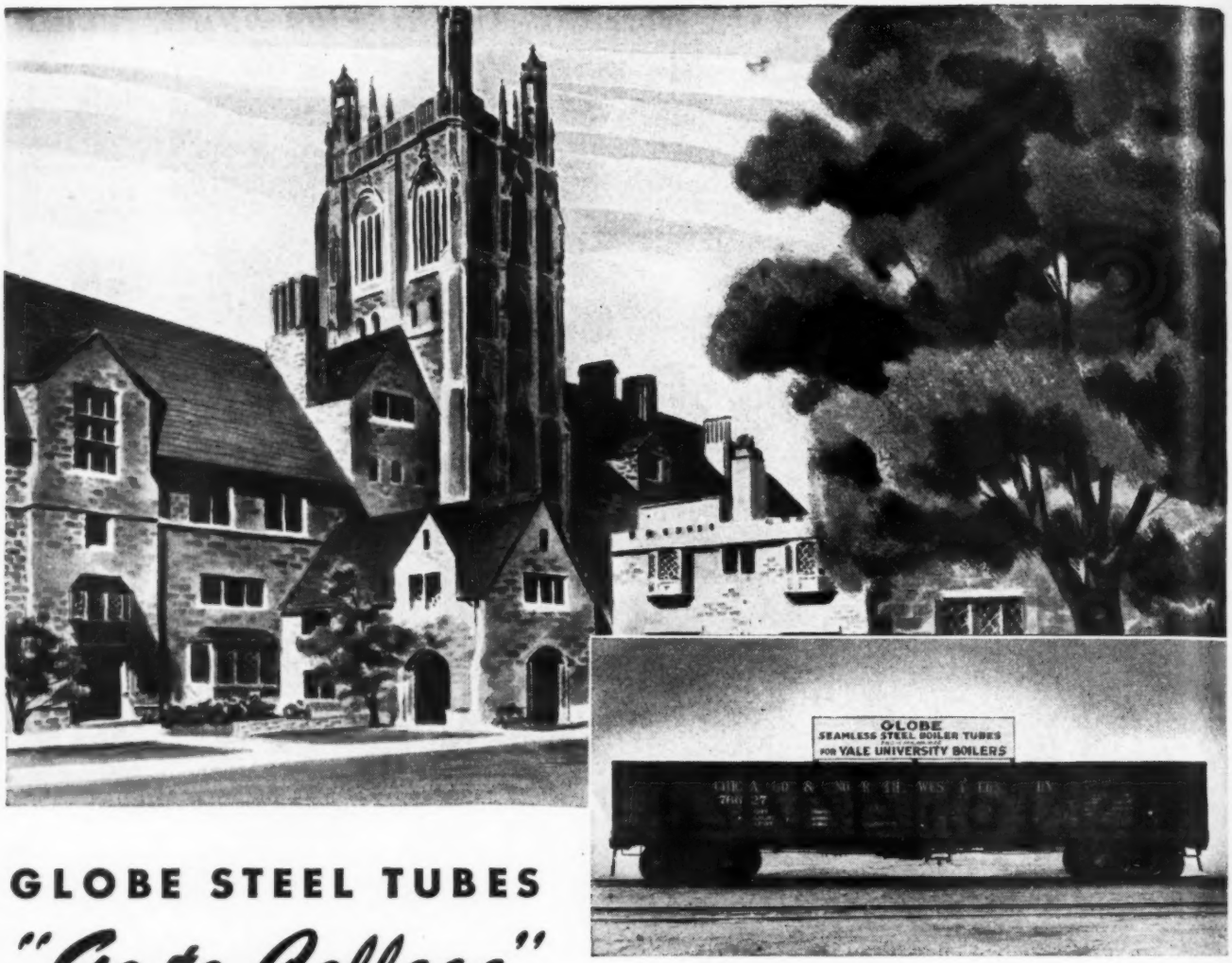
CP4-11

WORLD'S LARGEST MANUFACTURER OF PUMPS

STEAM POWER ROTARY TURBINE WELL CENTRIFUGAL



WORTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N. J.



GLOBE STEEL TUBES

"Go to College"

"The halls of learning" like Yale and Chicago Universities have at their command engineers and laboratories qualified to make all the critical tests on material bought for their own use. Globe Seamless Steel Tubes have gone into the boilers of their powerhouses to insure long and continuous operation at low maintenance costs.

Globe Seamless Steel Tubes of carbon, alloy, or stainless steel are made in a plant devoted for more than 30 years exclusively to the manufacture of steel tubing. Every order, large or small, is a special order and is checked at each stage of our exacting process of manufacture. The finished tubes are inspected with the most up-to-date testing devices to insure accurate filling of customer's specifications.

Globe Steel's customers have at their service our large technical staff and completely equipped laboratory. We will be glad to aid you in selecting steel tubing to meet your particular requirements.

★ STAINLESS TUBES
★ BOILER TUBES
★ GLOBEIRON TUBING
★ GLOWELD TUBES

GLOBE TUBES

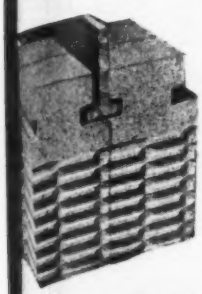
★ CONDENSER AND HEAT EXCHANGER TUBES
★ MECHANICAL TUBING

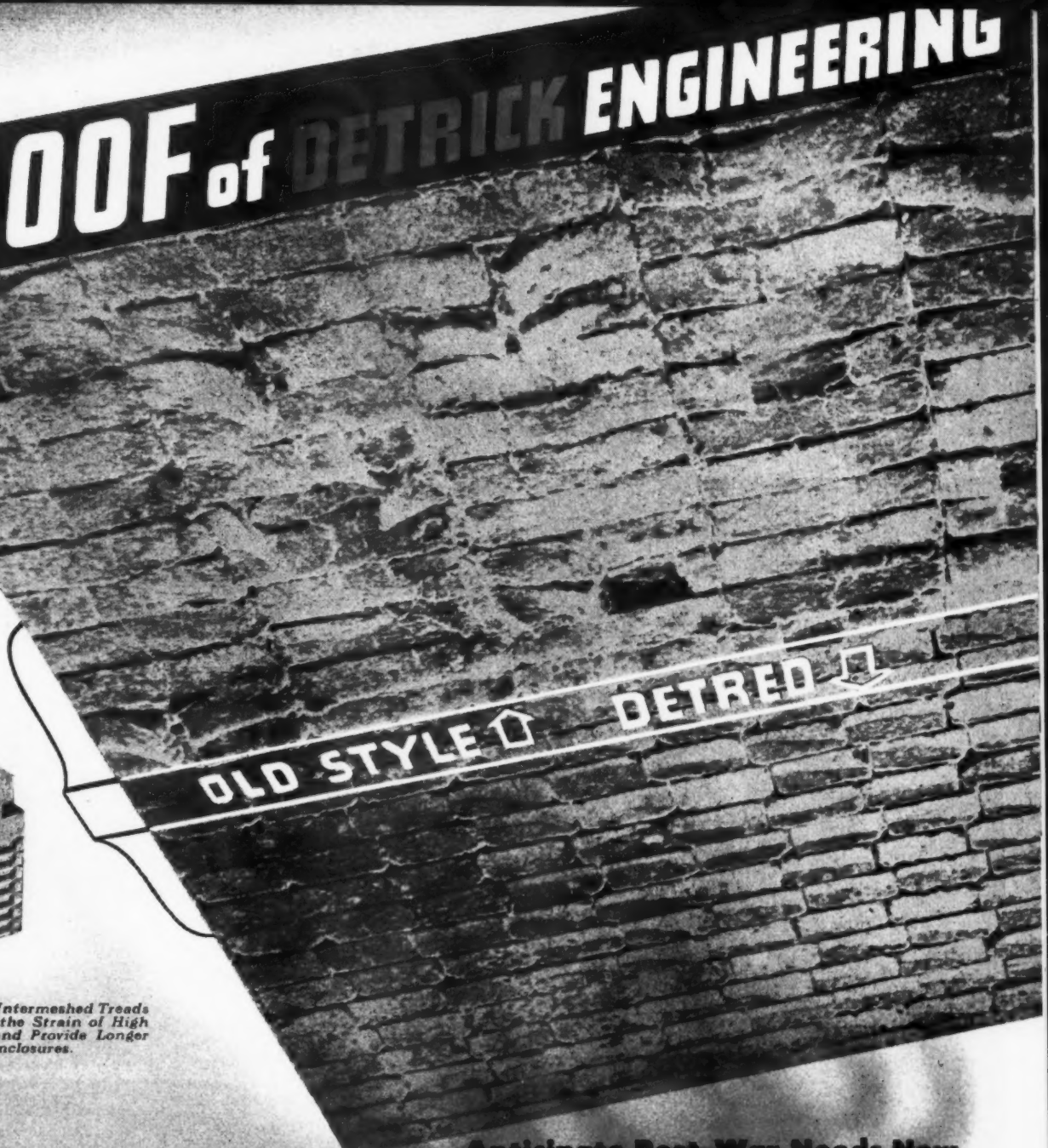
GLOBE STEEL *Tubes*

5010

GLOBE STEEL TUBES CO., *Milwaukee 4, Wis., U. S. A.*

PROOF of DETRICK ENGINEERING





d Tile With Their Intermeshed Treads Small Size Stand the Strain of High ntures Better and Provide Longer Life for Furnace Enclosures.

Here is visual proof of the soundness of one of Detrick's construction principles, namely: small sized tile suspended, bonded and intermeshed. The photograph shows an arch in which both large tile and Detred Tile were used for the same period, under the same service conditions. Note that the larger sized tile are in most cases split and are spalling badly. The Detred area is sound and tight.

In thousands of furnaces and other heat enclosures throughout the country the soundness of Detrick engineering has been proved by the way the arches and walls have stood up under the extra over-capacity operation of war effort. It is when extra severe service is needed that the thirty years of Detrick engineering experience shows up best.

Anticipate Post-War Needs Now

It won't be long before we will all be looking for post-war business, and the wise ones are avoiding the rush. If you have plans for modernizing your present equipment or for the installation of new boilers or furnaces, send your print and let our engineering department make suggestions. In the meantime ask for a copy of our 80-page catalog entitled DETRICK FURNACE ENCLOSURES which will bring you up to date on this most important subject.

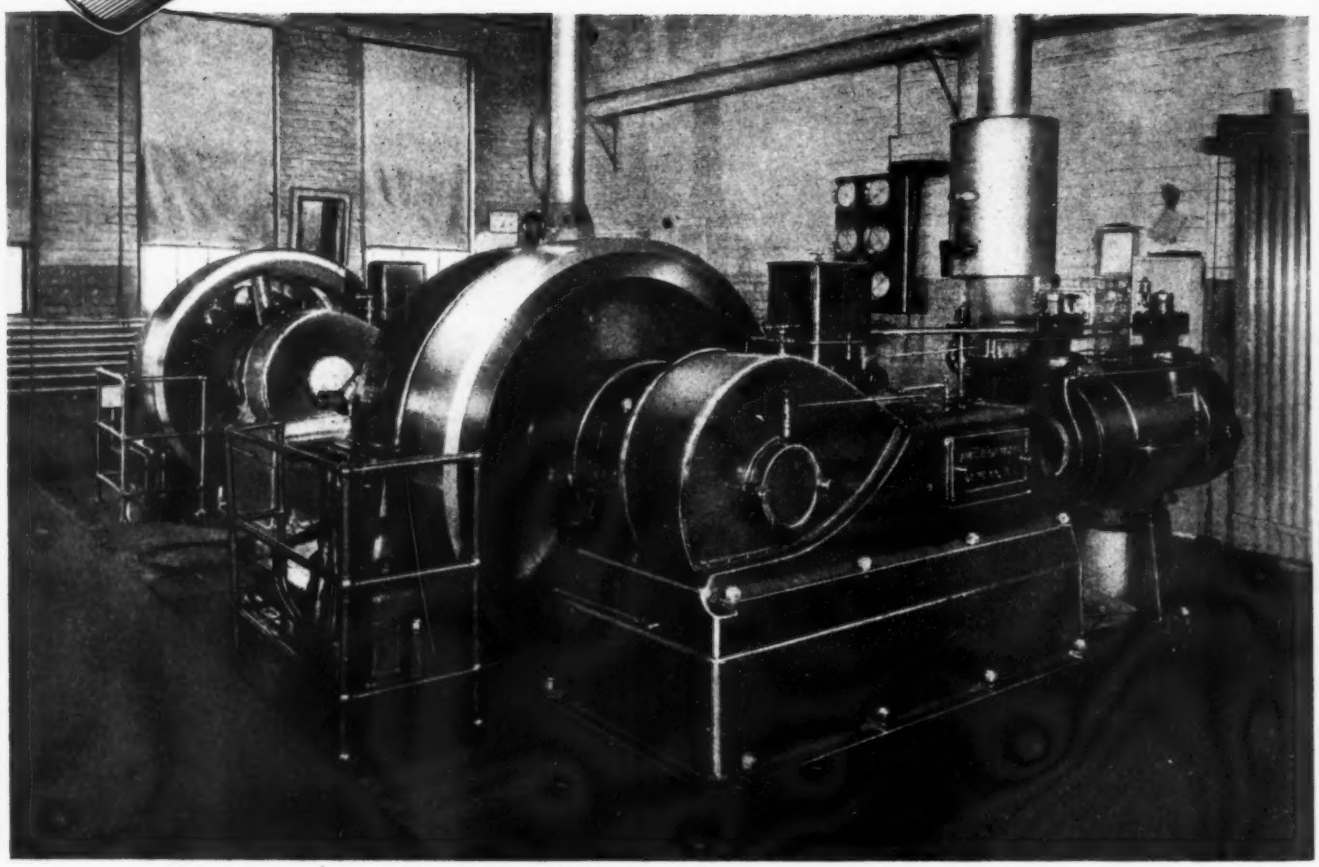
M. H. DETRICK COMPANY
111 West Washington Street, Chicago 2, Ill.

If it's a problem of enclosing heat, it's a job for Detrick

DETRICK FURNACE ENCLOSURES

USE DETRICK INSULATION . . . PLASTIC or BLOCK

Better LUBRICATION MEANS *Better Maintenance*



• Excessive wear and difficult maintenance often result from inadequate lubrication.

Sinclair provides Steam Cylinder and Valve Oils for *better lubrication* and better maintenance of *STEAM ENGINES*. These oils reduce wear under all load conditions and satisfy any combination of speed, temperature, pressure, moisture requirements.

• • •

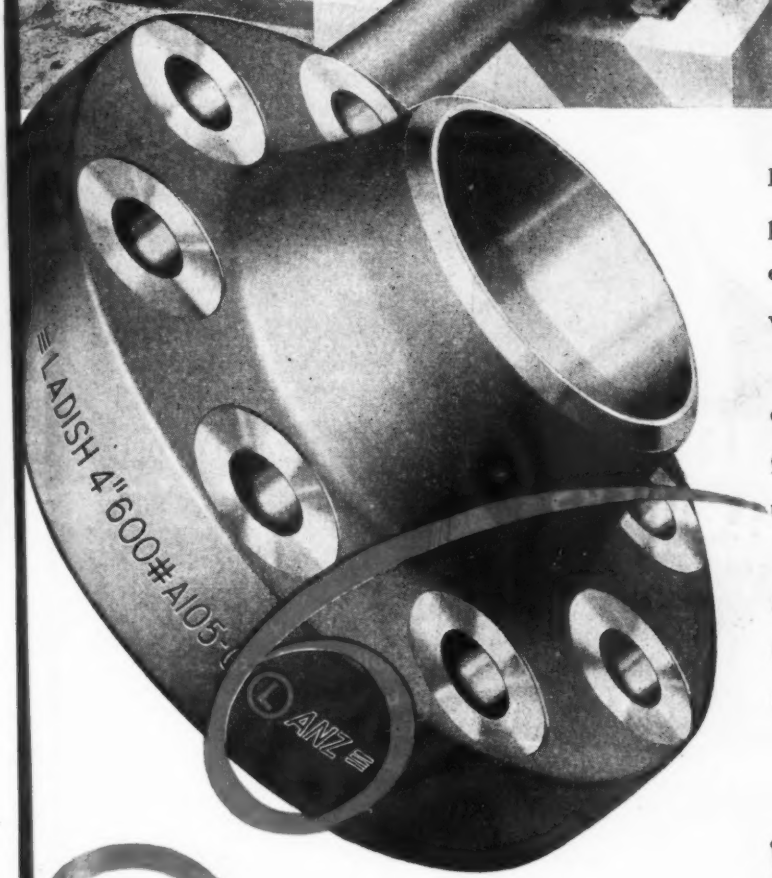
(Write for "The Service Factor" — published periodically and devoted to the solution of lubricating problems.)

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

On High Pressure Pipelines like this

LADISH Controlled Quality FORGED STEEL FLANGES ASSURE WELDABILITY



In producing forged steel flanges for all types of pipeline service, the rigid metallurgical control exercised by Ladish Drop Forge Co. assures that welding requirements will be met.

On installations like these, where varying conditions exist, Ladish green colored *Controlled Quality* Forged Steel Flanges can be depended upon for unfailing service.

Upon request, and by referring to the Ladish *heat code* permanently stamped on every flange, the user can obtain certified reports of the analyses of the steel from which the flange was forged.

Steel identity stamped on each flange was pioneered by Ladish and has been a Ladish standard for many years

ARMY E NAVY

FITTINGS DIVISION

LADISH DROP FORGE CO.

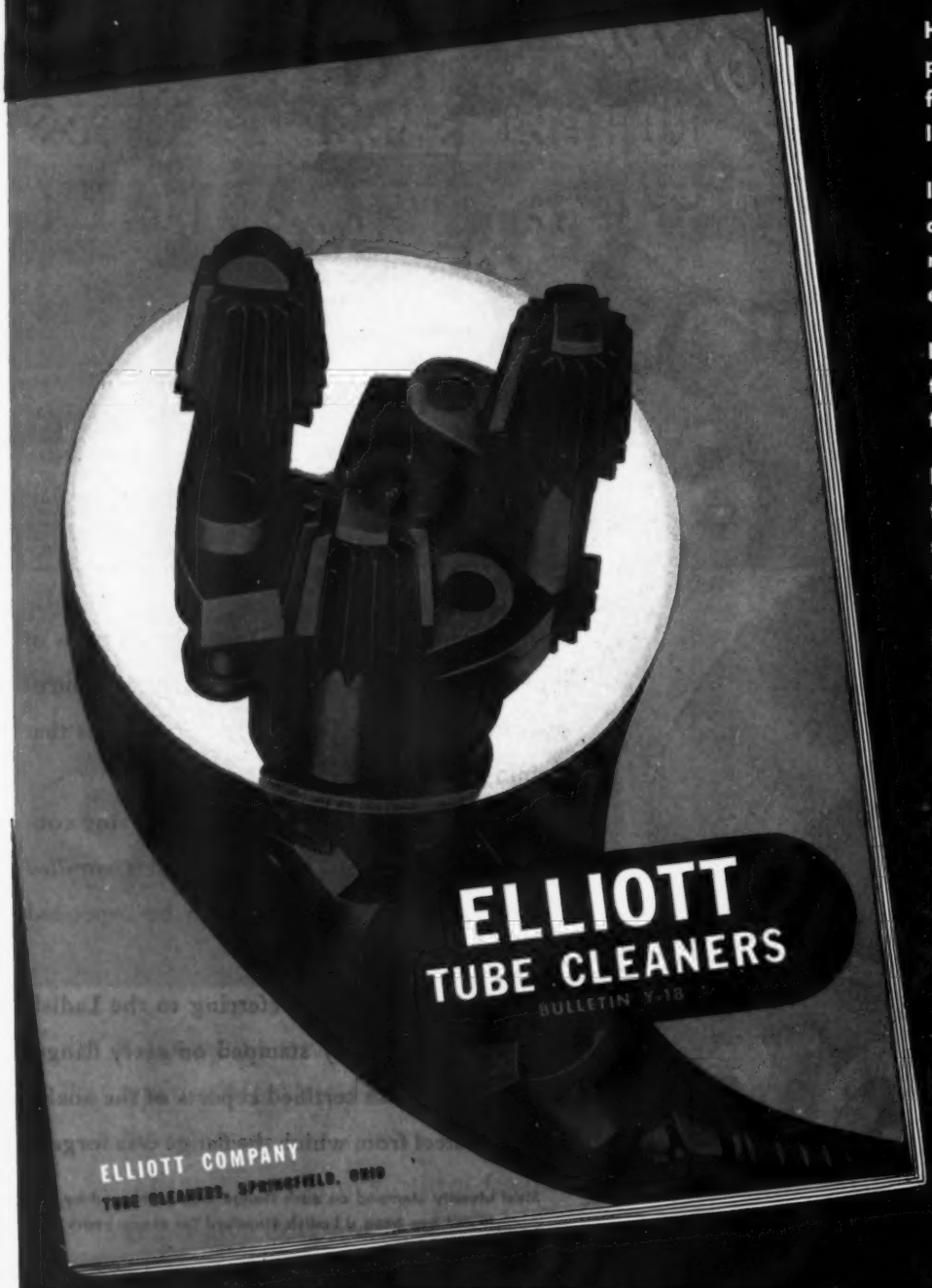
CUDAHY · WISCONSIN

MILWAUKEE SUBURB

New York Office: 60 East 42nd Street, New York City

TO MARK PROGRESS

Here's what you want to know about TUBE CLEANING . . .



How to clean tubes and pipes of any diameter, from ½ inch to 18 inches I. D.—

In condensers, heat exchangers, refinery apparatus, superheaters, boilers of all types—

In straight tubes, curved tubes, water tubes, fire tubes—

In removing all kinds of fouling—tough scale, sludge, soft deposit, refinery "coke"—

In specially difficult and unusual jobs, such as cleaning tubes under water—

With a complete and informative listing of cutter heads, drills, brushes; the motors that drive them; and the accessories that serve them.

•

Get this valuable new bulletin—the coupon will bring it to you.

Y-223

ELLIOTT COMPANY
Tube Cleaner Department, Springfield, Ohio

Send me the new Bulletin Y-18 on Tube Cleaners.

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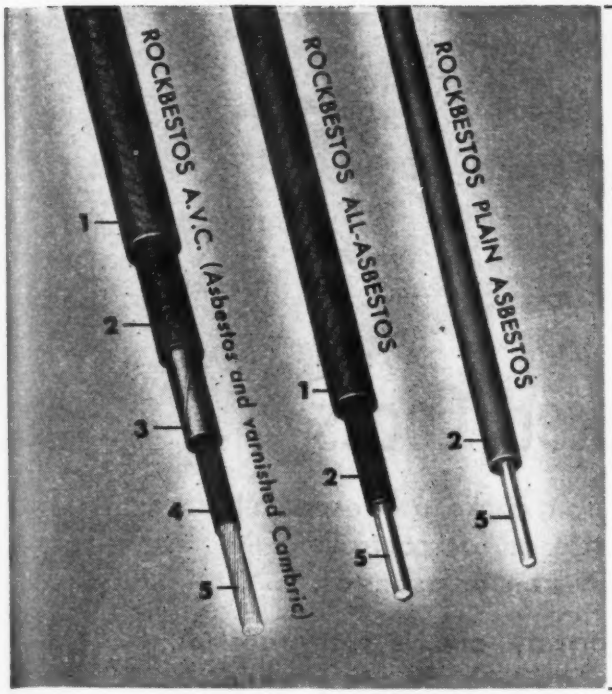


3 GETS YOU 122

122 wires, cables and cords, stemming from the three basic designs illustrated, have been developed by Rockbestos to give trouble-free performance under severe operating conditions in steel mills, power plants, chemical industries, etc. Send for catalog to see the rest.

Rockbestos Permanent Insulation Insures Long-Lived Performance

1. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.
2. Felted asbestos insulation impregnated with heat-, flame-, and moisture-resisting compounds will not dry out, become hard and brittle, or burn. Also serves as a heat-barrier against high ambient temperatures.
3. Lubricated varnished cambric for high-dielectric strength and added moisture resistance, protected from heat, flame, and oxidation by felted asbestos walls.
4. Felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.
5. The conductor is perfectly centered in helically applied insulation and will always remain so.

600 VOLT A.V.C. SWITCHBOARD WIRE—TABLE B
(Underwriters' Type AVB)

Sizes No. 18 to 4/0 A. W. G. with varnished cambric and felted asbestos insulation and gray, black, white or colored flameproof cotton braid.

Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is absolutely fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos A. V. C. Hinge Cable and Switchboard Bus Cable have the same fireproof and heatproof characteristics.

INDUSTRIAL HEATING CABLE—TABLE LH

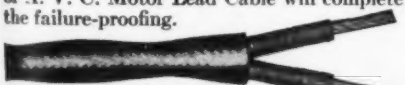
No. 19 A. W. G. nickel-chromium wire insulated with .040" of felted asbestos and covered with 1/64" waterproof lead sheath.

This pliable cable distributes a mild heat evenly over a large area. Prevents freezing of water pipes, wet pipe sprinkler systems, etc. Keeps conveyor pipes for fuel oil, soap, varnish, ink, chocolate, etc., at temperatures that insure steady flow.

ASBESTOS INSULATED MAGNET WIRE

Round, square and rectangular asbestos insulated conductors finished to meet varying winding conditions and coil treatment requirements.

Protect your motors against heat-induced breakdowns with class B windings of Rockbestos Heat-Resisting Magnet Wire. Leads of A. V. C. Motor Lead Cable will complete the failure-proofing.



ALL-ASBESTOS FLEXIBLE CORD—TABLE CA

Sizes No. 10 to 18 A. W. G. with two or three conductors insulated with felted asbestos, covered with asbestos braid. Also in A. V. C. (asbestos and varnished cambric) constructions.

This heat-resisting flexible cord is ideal for high-wattage lighting units, floodlights, blueprint machines, apparatus, etc., which require a heavy duty, enduring cord. For moisture-resistant construction specify the A. V. C. type. Labeled cord with polarized conductors if desired.

600 VOLT A.V.C. BOILER ROOM WIRE—TABLE C
(Underwriters' Type AVA)

Sizes No. 18 to 4/0 A. W. G. This construction for sizes 18 to 8, sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A. V. C. construction is ideal. Also for locomotive panel wiring and for switchboards requiring an asbestos braided wire.

THERMOSTAT CONTROL WIRE—TABLE TC

Sizes No. 14, 16 and 18 A. W. G. in two to six conductors with 12½, 25 or 31 mil wall of felted asbestos insulation and cadmium plated steel armor.

A multi-conductor control wire for low voltage intercommunicating, signal and temperature control systems. Its lifetime insulation and rugged steel armor will give you trouble-proof circuits.

600 VOLT ALL-ASBESTOS RHEOSTAT CABLE—TABLE R
(Underwriters' Type AI)

Sizes No. 18 A. W. G. to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this power and rheostat cable for wiring rheostats, switchboards, elevator and locomotive control panels and electrical equipment exposed to heat, fumes and fire hazard. Also for general open wiring in dry, high temperature locations. For solid conductor specify Rockbestos Rheostat Wire, Table A.

600 VOLT A.V.C. MOTOR LEAD CABLE—TABLE L
(Underwriters' Type AVA)

Sizes No. 18 A. W. G. to 1,000,000 CM insulated with two walls of felted asbestos and a high-dielectric, heat-sealed varnished cambric insert, covered with heavy asbestos braid.

Heatproof, fireproof, greaseproof and oilproof, will not dry out and crack, won't burn or carry flame, and remains permanently flexible. For coil connections, motor and transformer leads where extreme heat and fire hazards are encountered as in steel mills, etc.

600 VOLT A.V.C. CONTROL CABLE

In one to 19 conductors. Standard stranding A. W. G. No. 12—19/No. 25 and No. 9—19/No. 22. Other strandings furnished.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.

600 VOLT A.V.C. POWER CABLE—TABLE E
(Underwriters' Type AVA)

Sizes No. 18 A. W. G. to 1,000,000 CM insulated with laminated felted asbestos, varnished cambric, and asbestos braid. Other constructions for service voltages to 8000.

Recommended for power circuits and hot spot wiring in or around boiler rooms, steam tunnels, soaking pits, tenter frames, glass plants, etc. The asbestos and heat-sealed varnished cambric construction has ample moisture resistance and withstands high temperatures.

Rockbestos Products Corporation, 959 Nicoll Street, New Haven, Conn.

WON'T bake brittle, bloom, burn or rot—RESISTS heat, moisture, oil, grease and fumes

ROCKBESTOS

The Wire with Permanent Insulation

Fairbanks

Asbestos Packed Cocks

These extra-heavy vulcanized iron cocks are especially efficient for boiler blow-off service or for controlling the flow of acids which do not affect iron or asbestos.

The plug has a rectangular portway and is rust-proof. The V-shaped, dovetail grooves inside body are packed with long-fibred, graphited, vulcanized asbestos which compensates for any differentials of expansion between body and plug. Write for Catalog No. 42 and name of our nearest distributor.

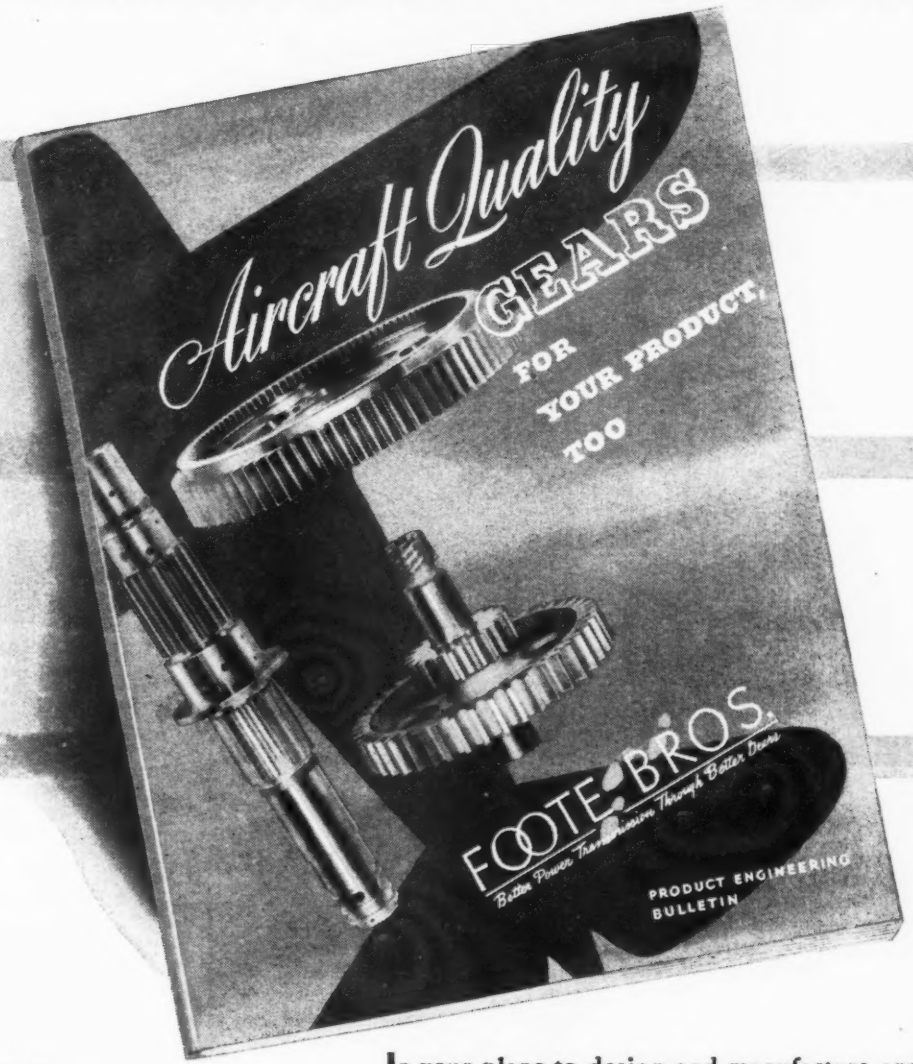
THE FAIRBANKS COMPANY

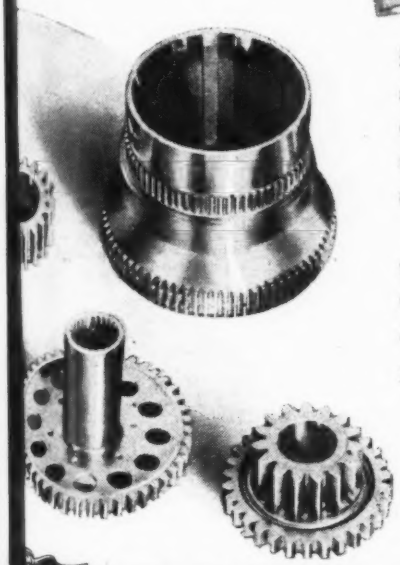
393 Lafayette St., New York 3, N. Y.

520 Atlantic Ave., Boston 10, Mass. • 15 Ferry St., Pittsburgh, Pa.

Better Power Transmission

THROUGH BETTER GEARS





In your plans to design and manufacture any equipment requiring the transmission of power, "Aircraft Quality" Gears offer your engineers the advantages of greater mechanical efficiency, lighter weight, longer life, greater compactness and quieter operation. These gears are now being produced in amazing quantities to power the world's greatest air force—they will be available to you as soon as war conditions permit.

A product engineering bulletin on these revolutionary gears is in preparation and will be sent to manufacturers interested in "better power transmission through better gears" as soon as it is off the press. If you would like to receive a copy when it is ready, mail the coupon below.

FOOTE BROS. GEAR AND MACHINE CORPORATION • 5225 S. Western Boulevard, Chicago 9, Illinois

FOOTE BROS.

Better Power Transmission Through Better Gears

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Please send me a copy of Engineering Bulletin on "Aircraft Quality" Gears as soon as it is available.

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1944

It's Too Late To Do *Anything* About This Fire

HERE'S HOW TO OUTFLANK FUTURE FIRES

Most plants have "hot spots." Yet, even in these locations, fires that start big and fast, can usually be extinguished quickly . . . with no break in production schedules . . . if you get at them *soon enough* with *enough* of the right extinguishing medium.

Cardox Guards Tough Hazards

It is no coincidence that frequently when hazards are toughest to handle protection is provided by Cardox Fire Extinguishing Systems.

A Cardox System—engineered for the specific hazards it covers—extinguishes both large and small fires, indoors and outdoors, by a timed *mass* discharge of Cardox CO_2. This non-damaging, non-contaminating fire extinguishing medium—stored at 0°F. and 300 p.s.i. in a single storage unit containing 500 pounds to 125 tons—is instantly available in TONS for large fires, IN POUNDS for small ones.

Enhanced CO_2 Performance

Enhanced extinguishing performance is possible because—as controlled and applied in Cardox Systems—(1) Cardox CO_2 has uniform extinguishing characteristics regardless of plant or atmospheric temperatures; (2) Applications can be engineered to the requirements of each indoor and outdoor hazard covered; (3) High CO_2 snow yield provides increased cooling effect (carbon dioxide released at 0°F. yields 45% CO_2 snow); (4) Effective projection through relatively great distances is achieved—even outdoors.

If you would like more information for use in solving current war plant fire protection problems—or in formulating fire protection plans that will prevent dangerous delays in getting post-war production in high—write on company letterhead for Bulletin 984.

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS

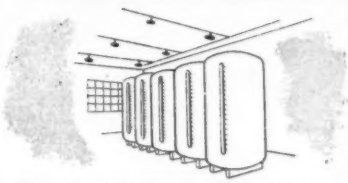
District Offices in
New York, Boston, Washington, Detroit, Cleveland, Atlanta, Pittsburgh, San Francisco, Los Angeles, Seattle

BUY WAR BONDS

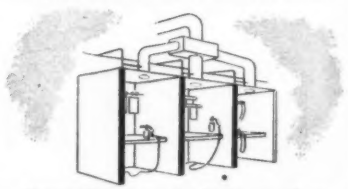
CARDOX
CO_2 FIRE EXTINGUISHING SYSTEMS

FOR EXAMPLE...

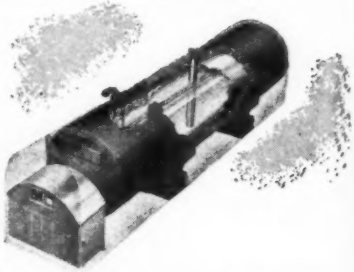
These are "hot spots" . . . one large . . . one small . . . typical of the hundreds where fire extinguishing performance provided by Cardox Systems assures maximum protection.



Here highly flammable oils are stored in long rows of tanks, each holding 10,000 gallons. If fire strikes, the Cardox System floods this huge room with cold, inert carbon dioxide in which fire cannot exist.

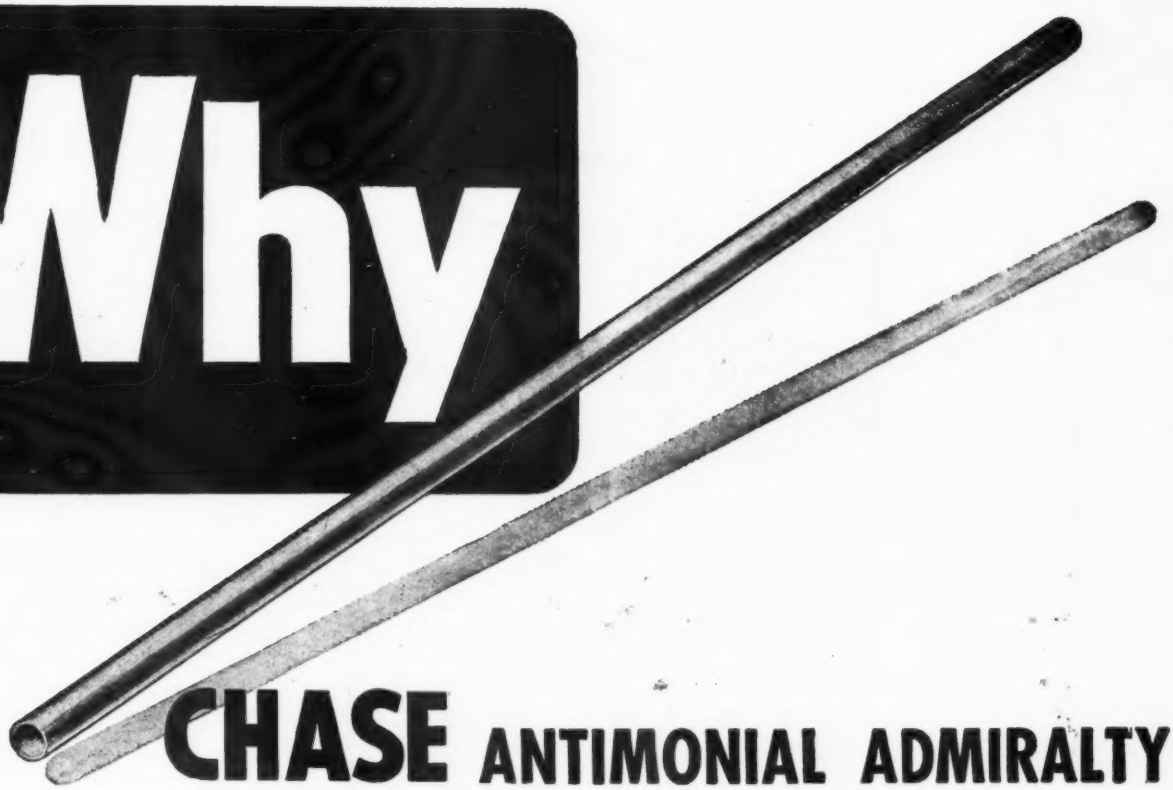


Spray Booths, relatively small in size, can start big fires. Local direct application of Cardox CO_2 prevents spread of fire and gives quick extinguishment within the booth and exhaust ducts.



Cardox CO_2 is maintained at controlled low temperature of 0°F. and 300 p.s.i., and is supplied instantly from a single storage unit.

Why



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Millions of pounds of Antimonial Admiralty tubes in service for periods up to eight years . . . and not a single failure has been reported from dezincification. This is the outstanding performance record of Chase Antimonial Admiralty. Yet, while the presence of antimony in this alloy reduces considerably the yearly costs of condenser tubes — by increasing resistance to dezincification — there is no increase in the initial cost of the tubes.

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For full information on Antimonial Admiralty, just phone the nearest Chase Sales Service Office.

*U. S. Pat. No. 2,061,931

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† Indicates Sales Office Only

This is the Chase Network — handiest way to buy brass

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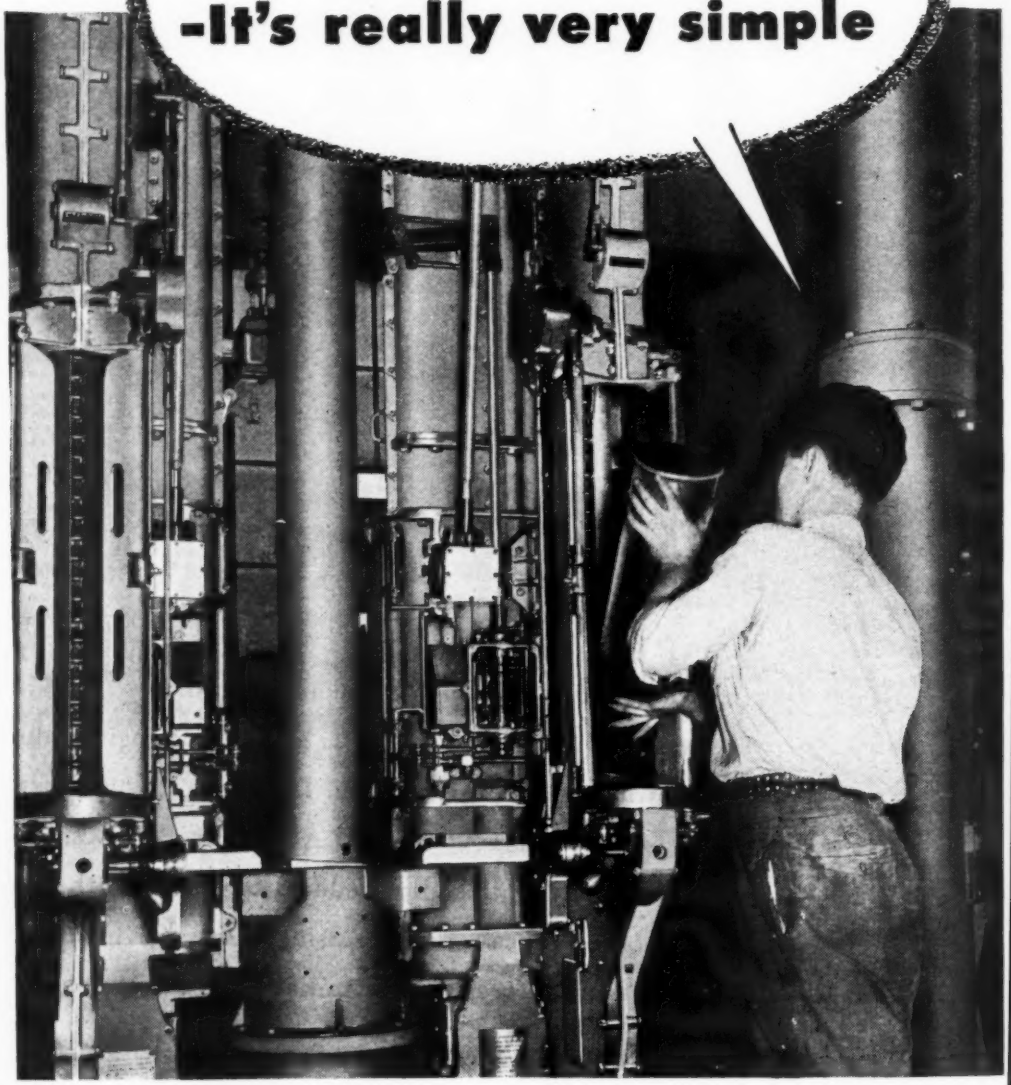

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(Censored)

(Censored) They have given magnificent results in action after action, even against dive bombers. Small wonder the Japanese accuse us of having artillery which operates on the machine gun principle."

* * *

Busch-Sulzer holds the Navy E and 3 stars for its 'round-the-clock production of twin ammunition hoists ever since America entered the war. Meanwhile, we have continued to build for the Army, Navy, Maritime Commission and high priorities Diesel engines up to 7500 BHP. They are of the type that has given Busch-Sulzer an enviable reputation for simplicity of design so essential to trouble-free operation and long life. An inquiry on your letterhead will receive prompt attention.

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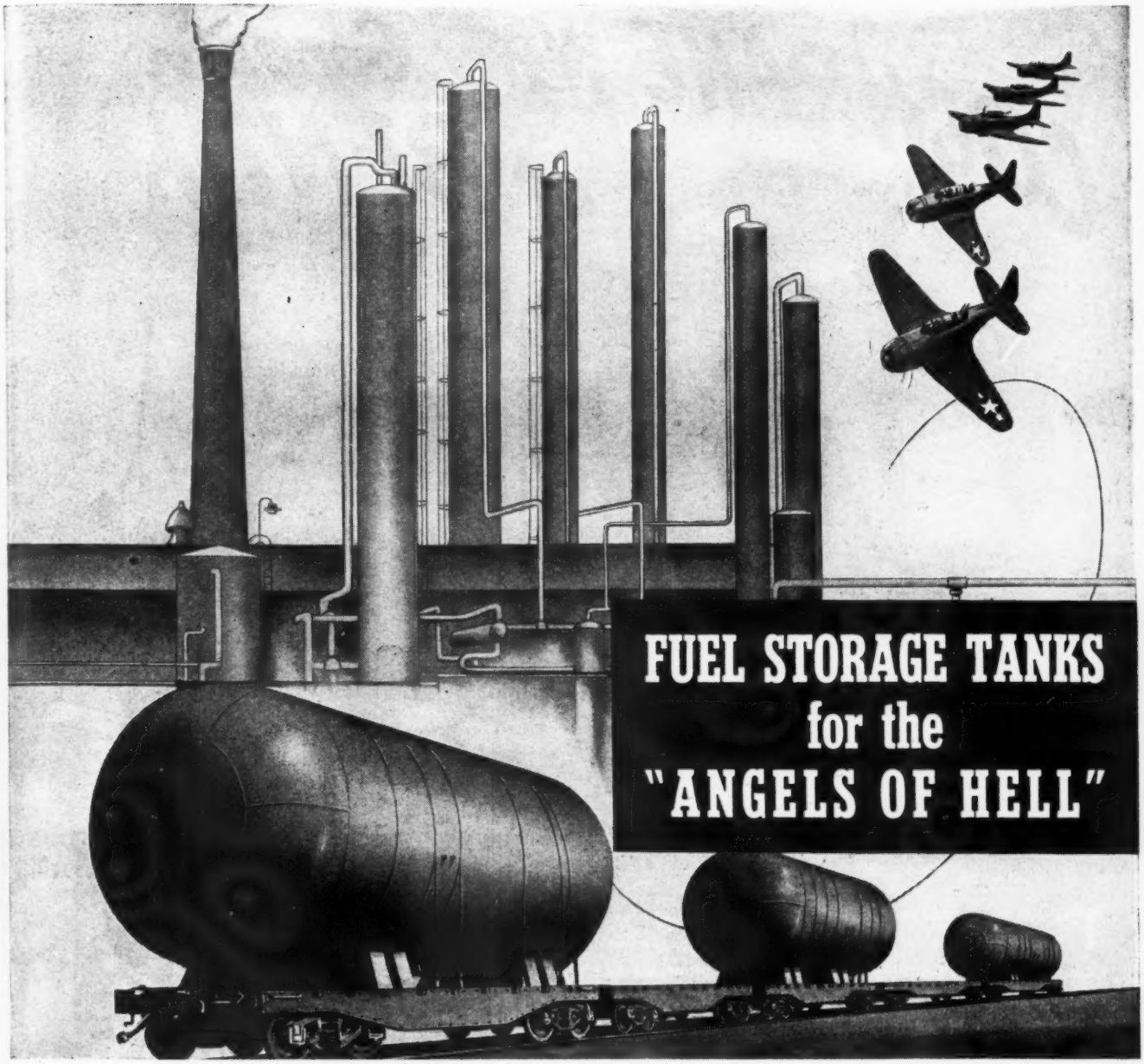

High-octane flying fuel is being manufactured and stored in enormous quantities in welded pressure vessels made by General American. In every quarter of the globe, military and industrial experts recognize the GATX symbol as signifying quality. GATX-built equipment, backed up by GATX Know-How, can effect production economies for *you!*

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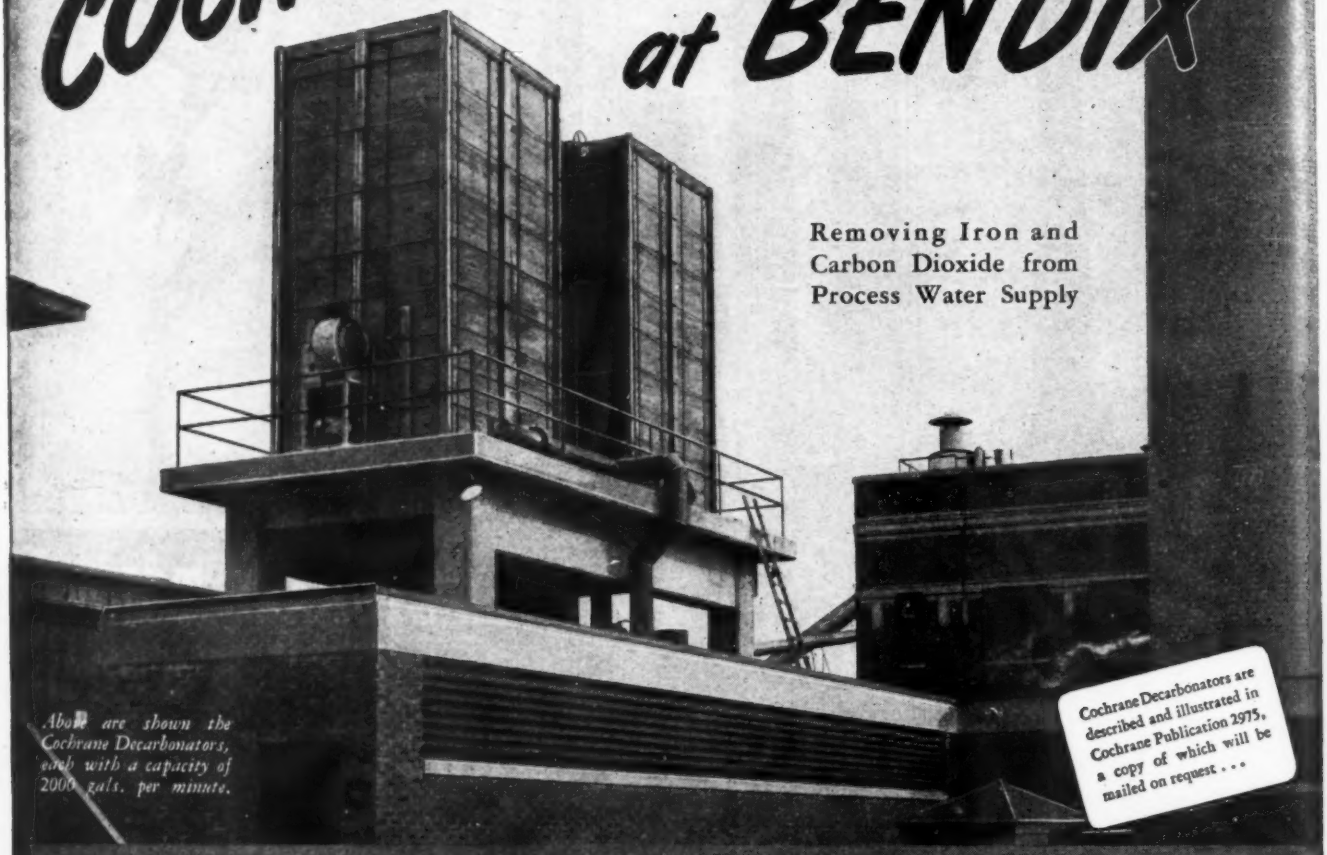
COCHRANE Water Conditioning at BENDIX

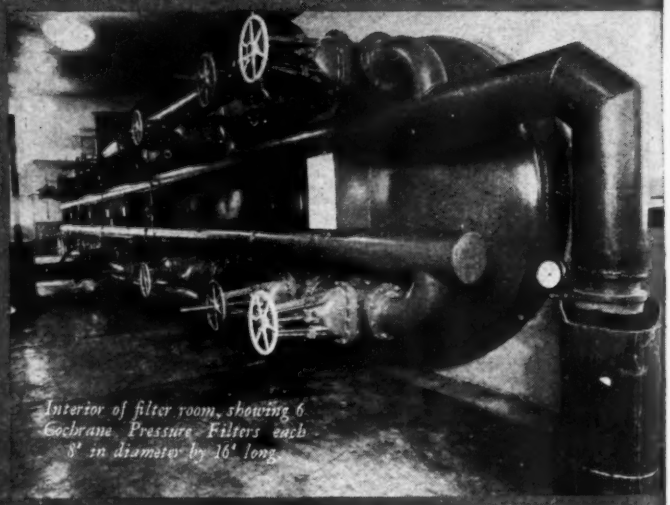
Removing Iron and Carbon Dioxide from Process Water Supply



Above are shown the Cochrane Decarbonators, each with a capacity of 2000 gals. per minute.

Cochrane Decarbonators are described and illustrated in Cochrane Publication 2975, a copy of which will be mailed on request . . .

THE war load on Bendix Aviation Corporation was naturally a very heavy one and involved rapid and extensive expansion of plant facilities. At the South Bend plant, water supply became a vital problem, which was solved by sinking two wells on the premises and installing the necessary pumps and pipelines. To insure the finest water possible, Cochrane water conditioning equipment was installed consisting of two rectangular Cochrane Decarbonators, each designed for a capacity of 2000 gallons per minute. By aeration, the iron is oxidized and precipitated and the carbon dioxide and some hydrogen sulphide removed. After aeration, the water is filtered through six Cochrane Pressure Filters, each 8' in diameter by 16' long, charged with sand and gravel. The installation is the largest of its type in the Midwest.



Interior of filter room, showing 6 Cochrane Pressure Filters each 8' in diameter by 16' long.

COCHRANE CORPORATION **3106 N. 17th ST., PHILADELPHIA 32, PA.**

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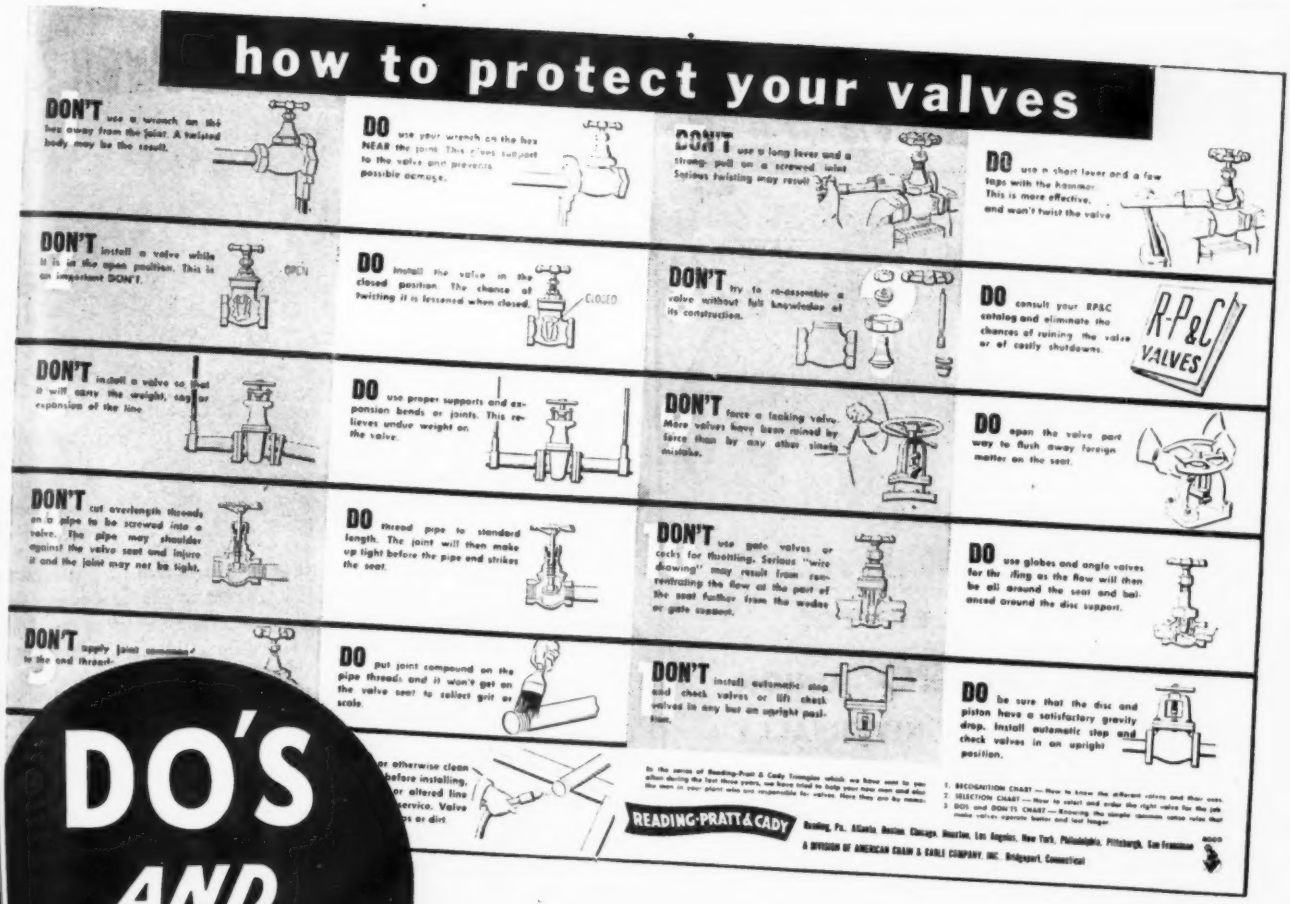
how to protect your valves
DON'T use a wrench on the hex away from the joint. A twisted body may be the result.
DO use your wrench on the hex NEAR the joint. This gives full support to the valve and prevents possible damage.
DON'T use a long lever and a strong pull on a screwed joint. Serious twisting may result.
DO use a short lever and a few taps with the hammer. This is more effective, and won't twist the valve.
DON'T install a valve while it is in the open position. This is an important DON'T.
OPEN
DO install the valve in the closed position. The chance of twisting it is lessened when closed.
CLOSED
DON'T try to re-assemble a valve without full knowledge of its construction.
DO consult your RP&C catalog and eliminate the chances of ruining the valve or of costly shutdowns.
R-P&C VALVES
DON'T install a valve so that it will carry the weight, sag or expansion of the line.
DO use proper supports and expansion bends or joints. This relieves undue weight on the valve.
DON'T force a leaking valve. More valves have been ruined by force than by any other single mistake.
DO open the valve part way to flush away foreign matter on the seat.
DON'T cut overlength threads on a pipe to be screwed into a valve. The pipe may shoulder against the valve seat and injure it and the joint may not be tight.
DO thread pipe to standard length. The joint will then make up tight before the pipe end strikes the seat.
DON'T use gate valves or cocks for throttling. Serious "wire drawing" may result from restricting the flow at the part of the seat further from the wedge or gate support.
DO use globes and angle valves for the throttling as the flow will then be all around the seat and balanced around the disc support.
DON'T apply joint compound to the end threads.
DO put joint compound on the pipe threads and it won't get on the valve seat to collect grit or scale.
DON'T install automatic stop and check valves or lift check valves in any but an upright position.
DO be sure that the disc and piston have a satisfactory gravity drop. Install automatic stop and check valves in an upright position.
or otherwise clean before installing.
or altered line
service. Valve
or dirt
READING-PRATT & CADY
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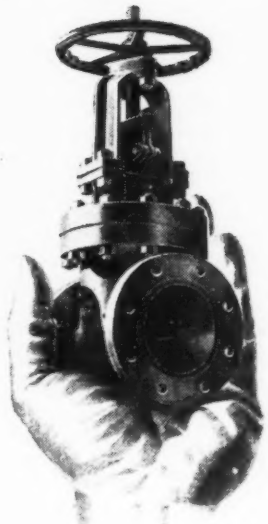
DO'S AND DON'TS

...TO MAKE YOUR VALVES SERVE YOU *BETTER-LONGER*



This is the third of the series of charts developed by Reading-Pratt & Cady as a service to the valve users of the nation. Like the other two—How To Know Valves and How To Select Valves—this one, How To Protect Your Valves, will serve as a reminder to experienced men and as invaluable information to new men in industry. It tells in pictures and simple, non-technical language how to avoid the mistakes that shorten the life of valves—how to get maximum service from them.

For copies of this chart, address our offices in Reading, Pennsylvania. There's no charge, of course.

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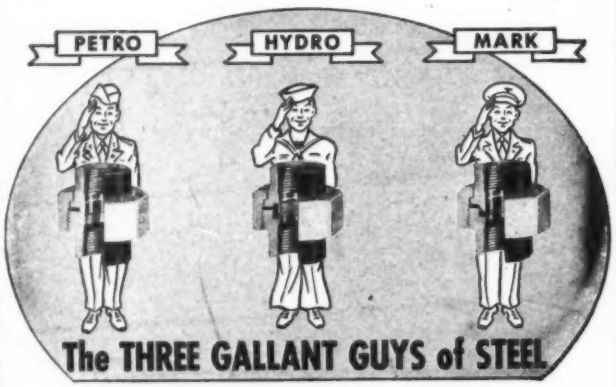

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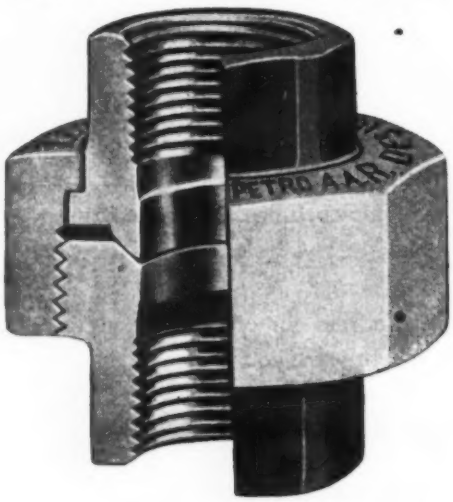

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WHEELCO FLAME-OTROL PROTECTS

Cleaver Brooks Steam Generators

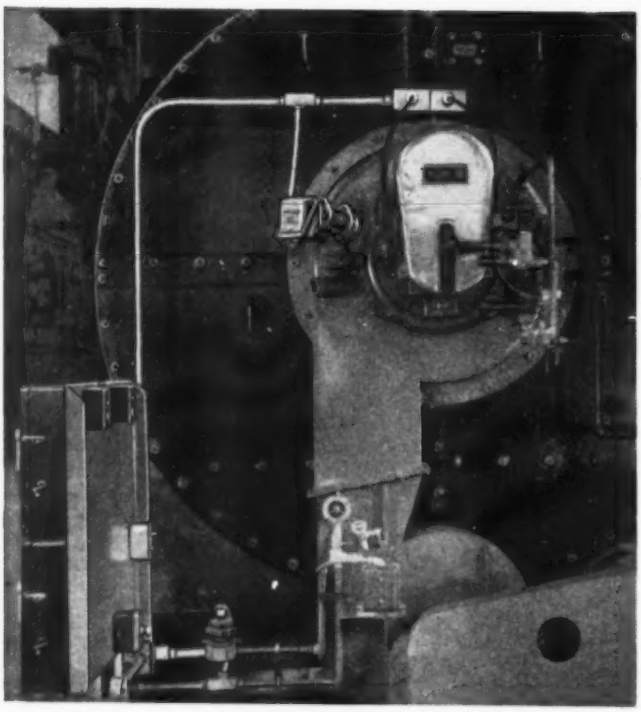

Photo courtesy of Cleaver Brooks Co., Milwaukee, Wisconsin.

One of many actual installations of Wheelco Flameotrols (with Flame-eyes) on Cleaver Brooks Steam Generators, manufactured by the Cleaver Brooks Company of Milwaukee, Wisconsin.

The Flameotrol system operates directly from the flame in the fire box, employing the "Electronic Principle" to instantly shut off the fuel supply in the event of flame interruption.

The Wheelco Flameotrol operates with equal efficiency on gas, oil, powdered coal or any combination of these fuels, and is available for manual starting or with automatic ignition.

WHEELCO INSTRUMENTS COMPANY

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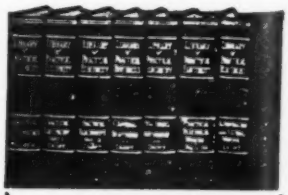

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Can you answer these questions?

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3. Do you know enough about electric circuits to figure wire sizes, resistances, etc.?
4. Do you understand principles of alternating currents and a.c. circuits—power factor, inductance, reactance, impedance etc.?
5. If you have to wire an old building with concealed wiring, do you know just how to go about it?
6. Do you know the National Electrical Code Rules and the reason for their adoption?
7. Do you have sufficient knowledge of mathematics to understand simple formulae, charts and graphs?
8. Do you understand the various factors or coefficients of electrical-energy-distribution systems used in central station practice and their application in the design and operation of central stations?
9. Can you complete a job of signal wiring, such as a fire alarm system or elevator system in a large plant?
10. Do you understand the operation and application of fluorescent bulbs?

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Engineering specialists in attendance at the numerous carefully-planned exhibits will give competent advice on the use and maintenance of products for use in the operation and maintenance of power plants. A display of tools for various power plant uses, will also be featured.

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This year's event will be keyed to the effective solution of continuing war production problems, particularly those caused by sudden shifts in military needs. At the same time, it will also provide informational sources for the advancement of your planning for the period of peace ahead.

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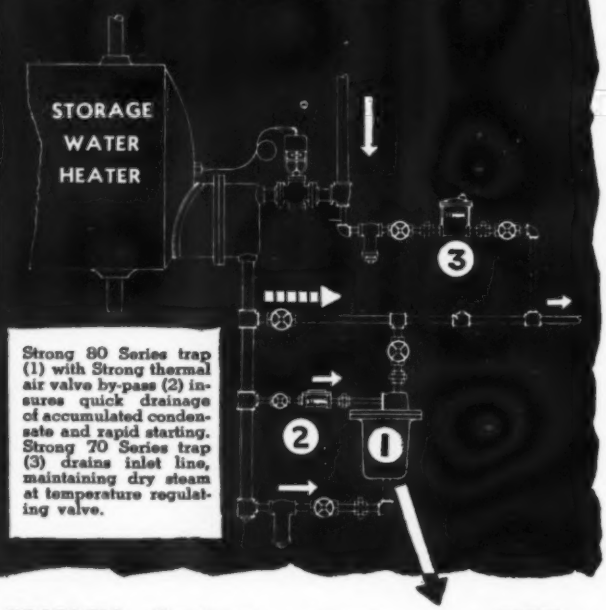
Plan to attend with as many of your associates as can be benefited. As in the past, the Exposition will be open by invitation and registration to visitors directly associated with power and production operations, but closed to the general public. No admission fee will be charged.

PREVENT DANGEROUS WATER HAMMER!



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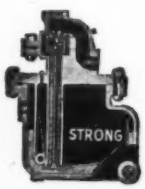

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STRONG
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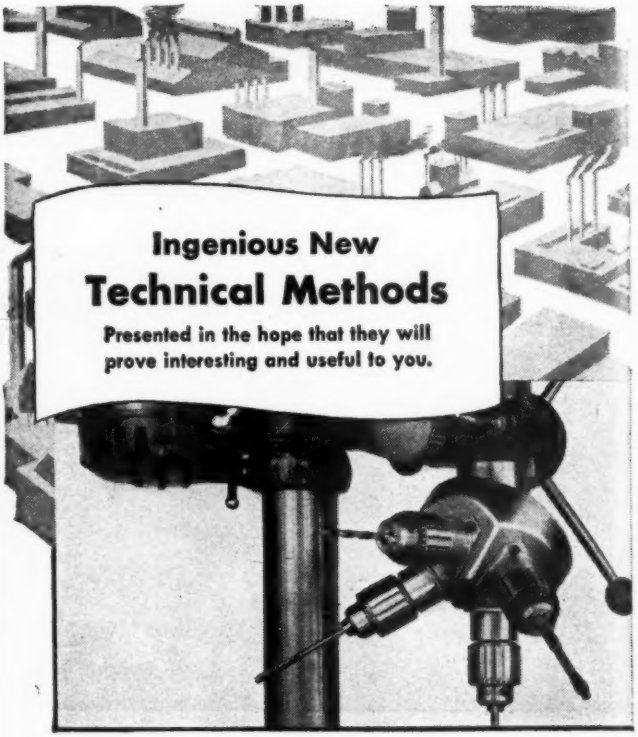

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New one drill press can do the work of four and, at the same time, effect a savings of up to 75% in floor space, with the "Quadrill" attachment. This rotary device will accommodate four boring or cutting tools at the same time, yet one tool *only* is in motion when the head is in operating position.

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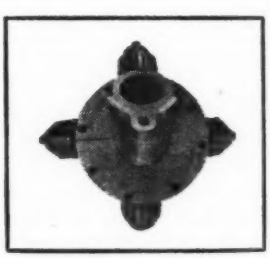
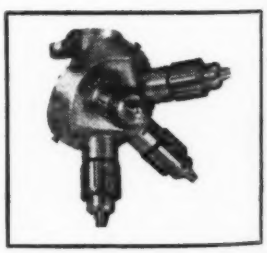
You can get complete information from Chicago Drillet Corporation, 919 North Michigan Avenue, Chicago 11, Illinois.



Quick and positive indexing assured by pointers on index disc



Quadrill assembly complete ready for attachment to drill press

Y-141

DIRECTED FLEXING

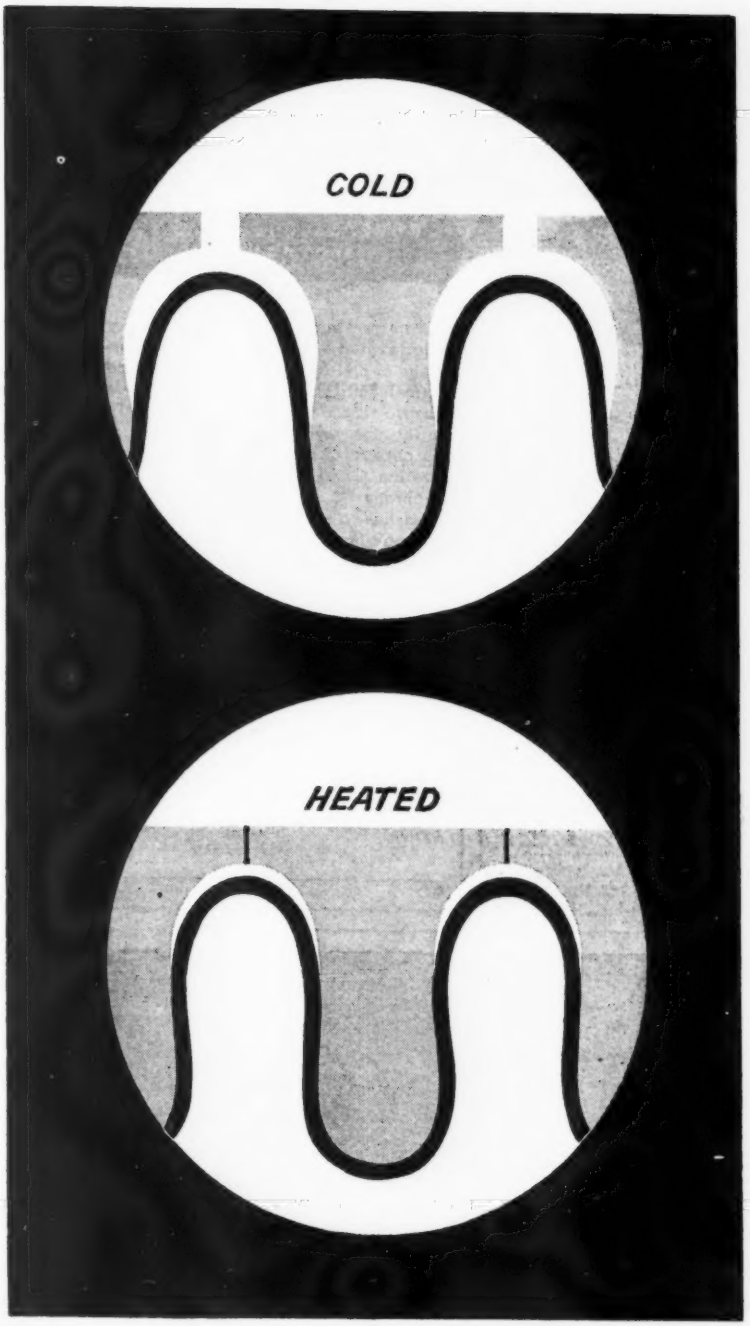
—WITHIN CONTROLLED SAFETY LIMITS

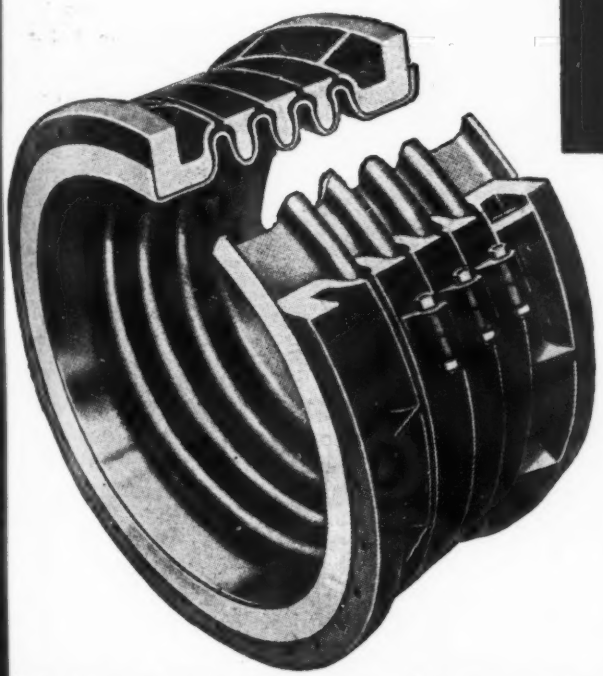
Expansion joint stresses simply can't get "out of hand" when Badger Directed Flexing Self-equalizing Corrugated Joints, correctly selected for the length and maximum temperature of the line, are installed.

Not only are the Badger corrugations inherently stronger — less subject to excessive localized stresses (as with corrugations having straight sides and angles or "junctions") — because of their ALL-CURVE design, but their flexing is DIRECTED and progressively controlled by corresponding Badger ALL-CURVE Equalizing Rings. These rings do two jobs: They help to distribute the stresses evenly over the contour of each corrugation and also evenly among the corrugations.

There are no other expansion joints with these unique features for ideal functioning, doubly assured dependability, and long life.

PACKLESS AND COMPACT. Being specially formed from a single piece of tubing, these superior joints require *no packing* — hence no packing maintenance (saving manhole and tunneling expense in underground installations). They waste no space — take up no more room than a comparable flanged fitting.





Made in Copper for normal pressures and temperatures; in Stainless Steel for higher requirements—and where corrosion is a problem. Single and multiple corrugations — to take care of traverses ranging from a fraction of an inch upward. Also made in Non-equalizing type for pressures and traverses that do not require the added protection of equalizing rings.

FREE BULLETINS: *No. 100 on Self-equalizing; No. 200 on Non-equalizing*

E. B. BADGER & SONS CO. • 75 Pitts Street, Boston 14, Mass.

AGENTS IN PRINCIPAL CITIES

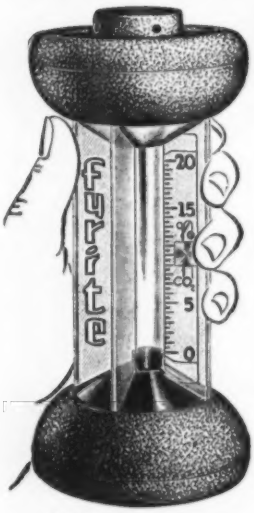
Badger

PACKLESS CORRUGATED EXPANSION JOINTS

COOPERATE with the NATIONAL FUEL EFFICIENCY PROGRAM **TO SAVE VITAL WAR FUELS**

USE THE **PRACTICAL FYRITE CO_2 INDICATOR**

REVEALS FUEL WASTE *INSTANTLY!*



$18.50 COMPLETE WITH INDUSTRIAL TYPE FLUE FILTER

CO_2 analysis of the flue gases is the only method available for determining the percentage of fuel wasted up the stack. The practical FYRITE CO_2 Indicator makes accurate flue gas tests easy—quickly pointing the way to adjustments and repairs necessary to secure efficient fuel utilization. The FYRITE requires no skill or technical knowledge; is simple and rugged; has no valves, clamps, or leveling bottle, no glass parts or batteries.

OXYGEN INDICATOR designed on same principle available soon. Write for particulars.

HEATING SERVICE DIVISION
BACHARACH
Industrial Instrument Co.
7000 BENNETT ST.
PITTSBURGH 8, PA.

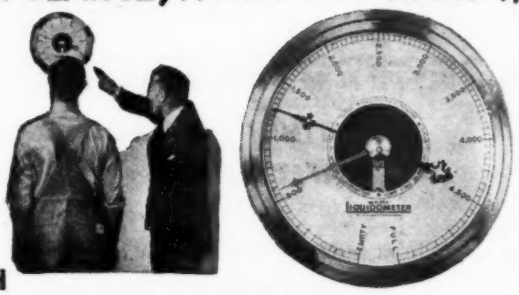
RETURN THIS COUPON FOR BULLETIN 341 on FYRITE. *Learn how to get immediate delivery under priority regulations.*

Name

Address

City State

ACCURATE LIQUID LEVEL INFORMATION AT A GLANCE, WHEN YOU WANT IT—



WITH

LIQUIDOMETER *Tank Gauges*

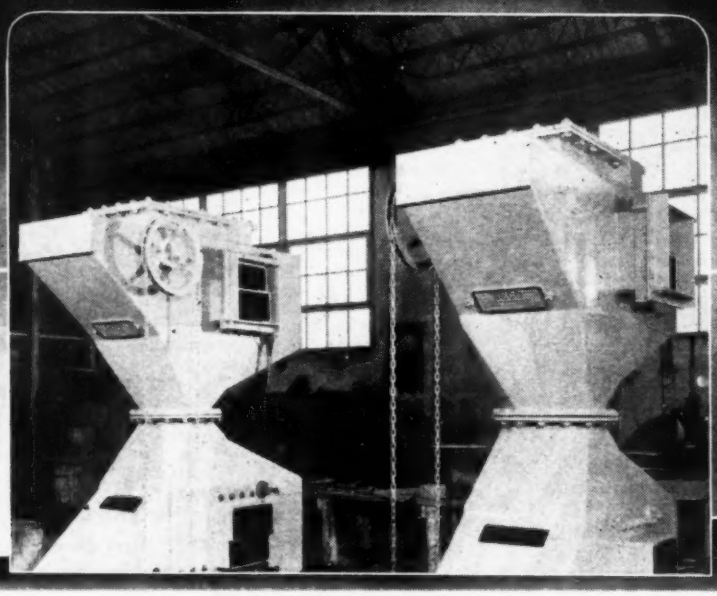
"THEY'RE ALWAYS DEPENDABLE"

100% automatic.
No pumps, valves, or auxiliary units needed to read them.
Models available for either remote or direct readings.
Accuracy unaffected by specific gravity of tank liquid.
Approved by Underwriters' Laboratories for gauging hazardous liquids.

Write for complete details.

THE **LIQUIDOMETER** CORP.
39-16 SKILLMAN AVE., LONG ISLAND CITY, I, N.Y.

"COAL VALVES *to give away"*



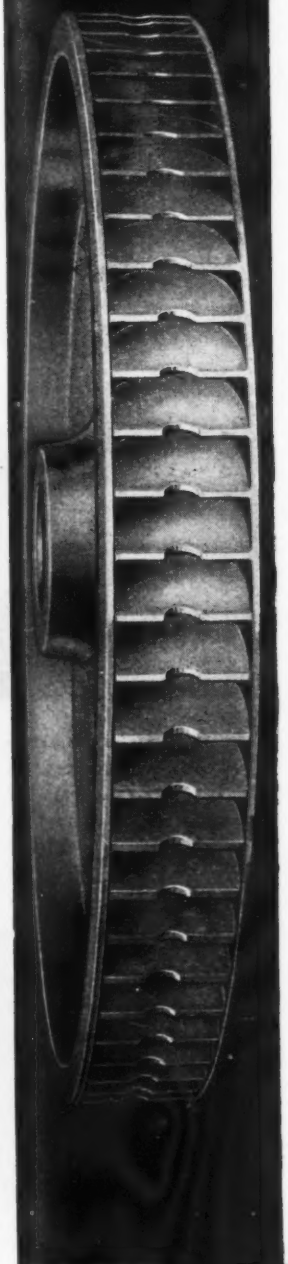
Shown above are two special S.E.Co. three-in-one coal valves, which you will agree we are "giving away" when you consider the savings their use will bring. Their unique construction combines three coal valves; one to feed distributor, one to feed conveyor and one to discharge-conveyor, for selective operation in the space ordinarily occupied by one valve. This design reduces height requirements by as much as 4 or 5 feet, thus the need for increased building height is eliminated.

Get full details *today!* Write to Stock Engineering Company, 715 Hanna Bldg. Cleveland 15, Ohio.

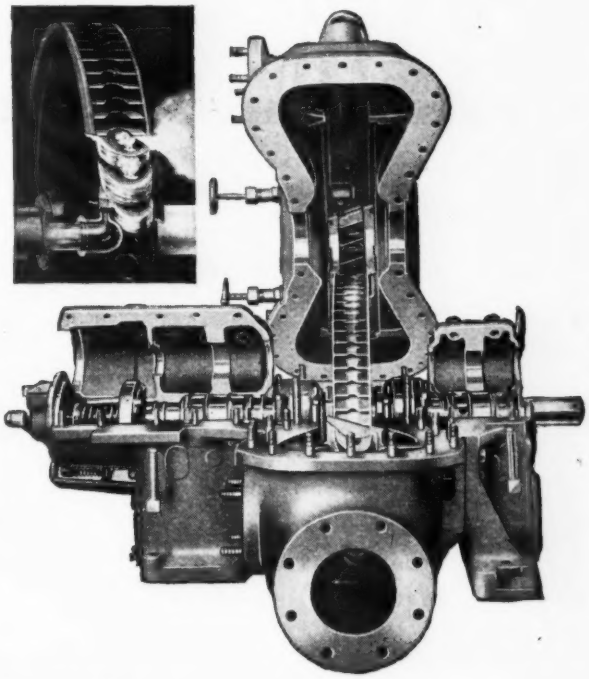
STOCK ENGINEERING CO.

CONICAL Non-Segregating Coal Distributors **S.E.Co. Coal Valves and Coal Scales**

TERRY



Action of steam in Terry solid wheel and reversing chamber.



Typical Terry Solid Wheel Turbine with casing cover and bearing caps raised. Note ruggedness and the accessibility of all parts. Units of this type are used to drive all types of power plant auxiliary equipment built in sizes from 5 H.P. to 2000 H.P.

THE TERRY WHEEL TURBINE- FOR AUXILIARY DRIVE— OFFERS MANY ADVANTAGES

FROM THE SMALLEST TO THE LARGEST, THESE RELIABLE TURBINES HAVE—

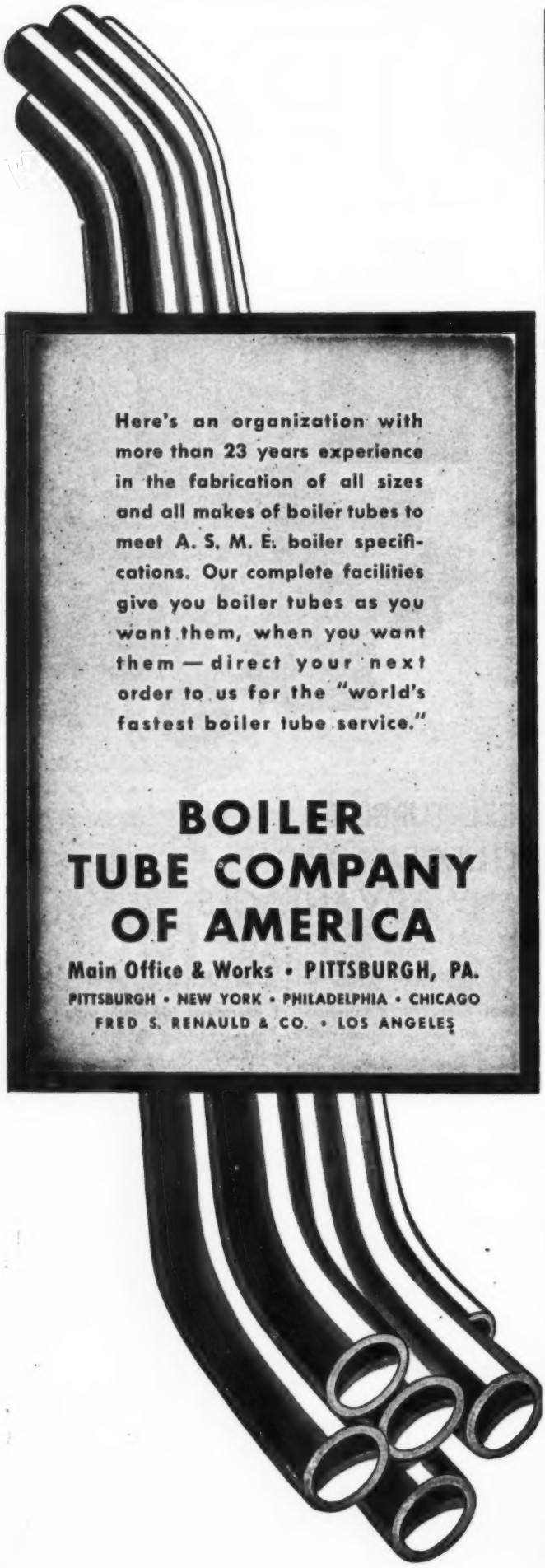
- ★ Indestructible one piece wheel.
- ★ Large radial and axial clearances.
- ★ Double rim protected blading.
- ★ Individual nozzle control.
- ★ Dependable and durable governor.
- ★ Heavy dust-proof bearing and governor housing.
- ★ Independent overspeed trip with separate valve.
- ★ Sturdy casing design.
- ★ Strong and easily inspected steam strainer.
- ★ Truly accessible construction, which makes inspection of the interior parts a simple matter.

FOR FULL DETAILS ASK FOR BULLETIN S-116.

T-1157

THE TERRY STEAM TURBINE COMPANY

TERRY SQUARE, HARTFORD, CONN.



Here's an organization with more than 23 years experience in the fabrication of all sizes and all makes of boiler tubes to meet A. S. M. E. boiler specifications. Our complete facilities give you boiler tubes as you want them, when you want them — direct your next order to us for the "world's fastest boiler tube service."

BOILER TUBE COMPANY OF AMERICA

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PITTSBURGH • NEW YORK • PHILADELPHIA • CHICAGO

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ADSCO – BANNON THE PERMANENT TILE CONDUIT

FOR TRANSMITTING STEAM FROM A DISTRICT OR CENTRAL STEAM HEATING PLANT

. . . to a building or group of buildings

. . . to an entire business or residential district

Made of vitrified clay tile. Installed with "Fiberglas" insulation. A Combination that can't be topped for permanency or efficiency.

Can be furnished for several combinations of pipe in the same conduit, thereby reducing cost.

ADSCO-Bannon Tile Conduit is a reasonably priced easy-to-install conduit equally good for the rush job to give temporary service, just as it is ideally designed to provide a permanent installation for a post-war industrial, college or institutional project comprising one or more buildings.

Split tile construction makes it easy to install a group of pipes. Pipes can be threaded or welded where you can get at them, then let down in place. Highly skilled labor not required.

Base drain carries away ground seepage water — keeps insulation dry — prevents undue heat loss.

Send us details of proposed installations for prompt quotation or write for illustrated bulletin No. 35-67PR.

POST WAR NOTE: Communities that install District or Central Heating for business or residential sections will provide needed employment — save fuel — eliminate furnace and boiler tending — enjoy cleaner buildings — reduce fire hazard and smoke nuisance — eliminate coal handling and ash removal.

AMERICAN DISTRICT STEAM COMPANY NORTH TONAWANDA, N. Y.

Making "UP-TO-DATE" Steam Line Equipment for over 60 years

TAKE A TIP.....

NOT A TAP...

to get instant, accurate Temperature Readings!

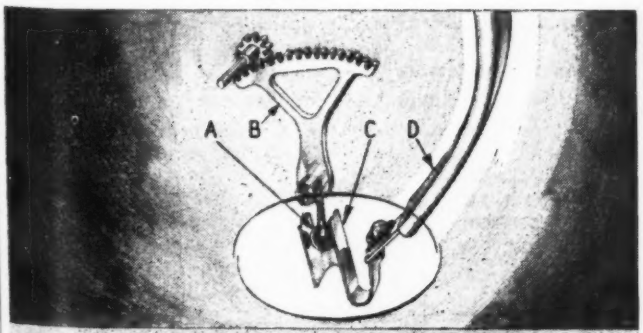
Exclusive Ball-and-Trough linkage gives Foxboro Dial Thermometers positive pointer movement, up and down the scale

When the pointer on a Foxboro Dial Thermometer points to any figure on the scale, *it always means just what it says.* And it takes no tapping of the dial face to make it tell the truth!

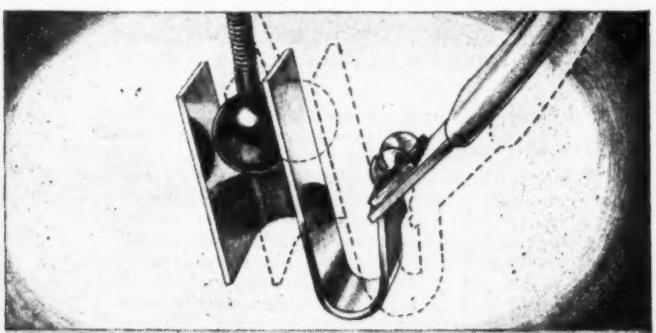
The exclusive Ball-and-Trough linkage in this better-engineered instrument eliminates lost motion . . . insures positive positioning of the pointer, no matter which way temperatures move. What's more, it also eliminates all the angularity errors of lever-type linkages . . . gives uniform, accurate calibration over the entire scale!

Add to this *inherent* accuracy, the *accuracy-in-use* features of Foxboro Dial Thermometers: rugged, all-metal construction — accessible mounting of the indicator anywhere up to 200 feet from the bulb — airplane-type dials that can be accurately read from a distance of 20 feet. You get a lot of extra value, at no extra cost!

Write for full details in Bulletin 148-7. **The Foxboro Co., 68 Neponset Avenue, Foxboro, Massachusetts.** Branches in principal cities.



Circled is the exclusive Foxboro Ball-and-Trough linkage. A stainless steel ball (A) integrally connected with the gear segment (B) slides, practically without friction, in a chromium-plated trough (C) attached to the Bourdon Tube (D).



Enlarged view of Foxboro Ball-and-Trough. Dotted lines show typical change in position corresponding with change in temperature. This linkage provides constant, tangential point-contact . . . eliminates lost motion and angularity errors.

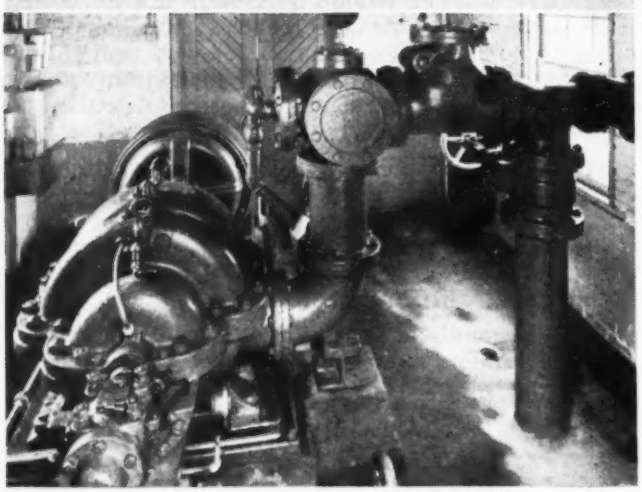
FOXBORO DIAL THERMOMETERS

REG. U. S. PAT. OFF.

Goulds

the PUMP FOR the JOB

Are your pumps suffering from W.W.F.?



Installation of Goulds fire pump—Fig. 3089-99

Have your pumps been affected by "War Work Fatigue"? Has the pressure of war work forced you to overwork your pumps? Are you nursing them along while needed replacements are so difficult to obtain? Will your present boiler feed pumps, for example, still be in shape to handle the equally heavy demands of postwar operations?

When it's time to start action on your postwar plans, why not let Goulds Pumps supply the cure for W.W.F.? Goulds, who have been specializing in pump building for over 96 years, will be able to supply you with the pump for the job—whether it be for boiler feeding, hot and cold water circulating, sump, cooling tower, or any other power plant service.

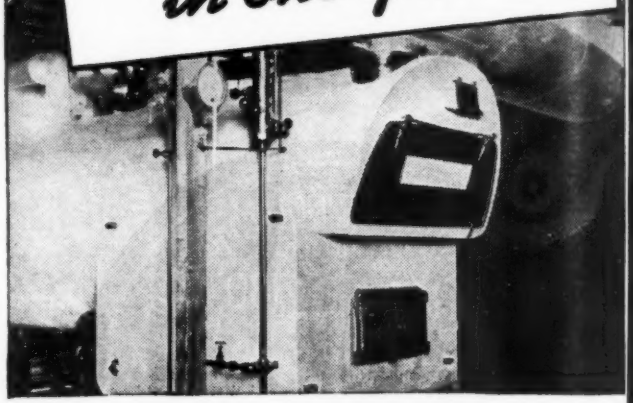
Goulds PUMPS INC.
SENECA FALLS, N. Y.

CASE No. 1

Mineral Wool Insulation on a Boiler Shell can

SAVE

165 tons of Coal in one year!



Free

Heat and Power Conservation Manual tells how you can save fuel in your plant. Write for copy

Is there any surface on your equipment too hot to touch? If there is, you need this Manual. It tells you how to step up production and conserve valuable fuel—how to use Mineral Wool Insulation on boiler drum heads, hot storage tanks, ducts and breachings, pipes and fittings, feed water boilers, driers and ovens, flanges, boiler shells and boiler fittings.

Mineral Wool has extra low thermal conductivity. It is light, easy to apply, low in cost. No other insulation does so much for so little.

Cooperate with your government's drive to save critical fuel. Stop heat losses now. Send for your copy of this free manual today. Write to Industrial Mineral Wool Institute, 441 Lexington Avenue, New York 17, N. Y. Dept. P9.

☆ ☆ ☆

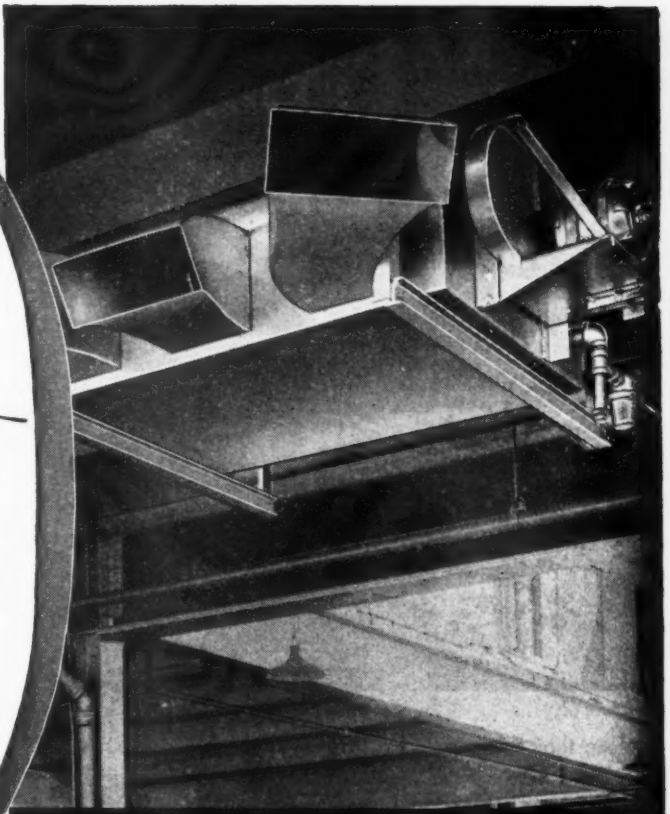
Mineral Wool Insulation is also effective for controlling cold temperatures and is an excellent fire-retarder.

MINERAL WOOL INSULATION PRODUCTS
for high and low temperatures
BLANKETS · FELTS · BLOCKS · CEMENTS · PIPE COVERINGS · FILL MATERIALS

STOP
COLD WEATHER
ABSENTEEISM

USE

CLARAGE
UNIT HEATERS



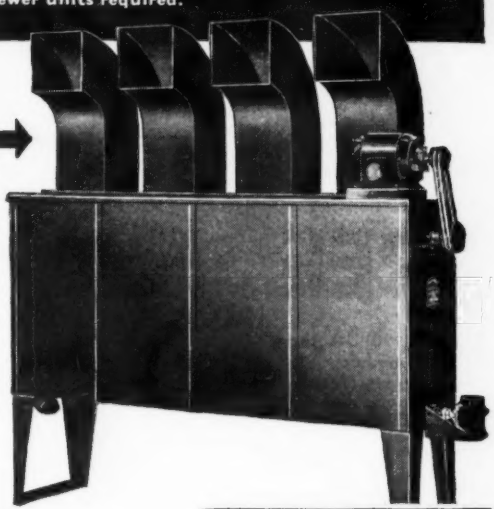
Suspended type Unitherm Unit Heater — no floor space needed — easily installed. Note SQUARE OUTLETS which are quickly adjustable for 4 different directions of heat flow. All Unitherm type heaters are equipped with centrifugal fans — one for each outlet. This means heat delivered at HIGH VELOCITY over wide areas — fewer units required.

Cold weather not so far away! Check your heating NOW! Don't let common colds and other kindred ailments, due to inadequate heating, cause a sharp rise in absenteeism among your workers.

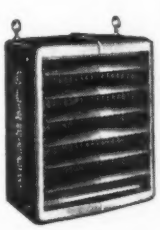
★ For keeping any type of industrial plant warm and comfortable—an entire building or part of it—Clarage Unit Heaters offer many important advantages.

★ They meet temperature, time and space requirements with precision exactness. You get the heat you need where you want it, and when you want it! You save in first cost. And the entire installation job is simple; inexpensive.

★ *Built in a liberal range of sizes, operating on steam or hot water. Performance guaranteed—thousands of units in service. Prompt deliveries. No obligation to have Clarage engineers submit complete recommendation—write or phone us today!*



Floor type Unitherm Unit Heaters simplify your layout — save piping and trap costs. All parts readily accessible by removing front or back section of heater casing. V-belt drive permits flexibility of fan speed; assures quieter operation.



Small propeller fan unit heaters for places where more heat is wanted — to help out present equipment. Easily installed along side walls or at ceiling line.

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COMPLETE AIR CONDITIONING
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COOLING
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VENTILATION
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FACTORY HEATING
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MECHANICAL DRAFT
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FANS and BLOWERS for INDUSTRIAL NEEDS

Clarage Fan Company Kalamazoo 16, Mich.

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SMOOTH-ON REPAIR RECORDS

CRACKED BALL MILL

The ends of the crack were drilled and plugged and its edges beveled slightly with a sharp scraper. Smooth-On No. 1 was then applied under a reinforcing patch-plate and into the crack. The mill was again ready for use as soon as the Smooth-On hardened.

FOLLOW THIS SERIES OF SMOOTH-ON SAVINGS

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For over 45 years, Smooth-On has been used for making practical, speedy, economical and lasting repairs . . . sealing cracks in pump, engine, valve and pressure castings, stopping leaks in pipelines and process equipment. Its outstanding record of successful routine and emergency repairs has made this iron cement a necessity in the repair kit of tens of thousands of engineers and mechanics.

FREE Repair Handbook Shows How

40 Pages, 170 Diagrams, simple practical instructions for ingenious repairs to plant equipment, pipe lines, structures. Based on experiences of engineers all over the country. To obtain your FREE copy, just fill in and mail the coupon.

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The Iron Repair Cement of 1000 Uses

Are You Familiar with what *Airetool* PRODUCTS can do for you?

New boiler tubes are costly to replace and their installation deprives you of much needed power when your boiler is down. To protect your present tubes and to keep them properly rolled and free from scale calls for versatile Airetool Tube Cleaners and Tube Expanders — guardians of plant efficiency.

TUBE EXPANDERS

Airetool Tube Expanders are precision made by skilled workmen from the finest alloy steel in sizes and types for every tube. Special types for unusual conditions. Right angle or universal drives. Write for new Expander bulletin today.

TUBE CLEANERS

Airetool Tube Cleaners save time, labor and tubes. The new form special heat treated alloy steel cutters remove deposits thoroughly without tracking or damage to tubes. Made in sizes 1/2" to 20" I.D. for straight or bent tubes; air, steam or water driven. Write for further details.

Write Dept. P for Bulletins.

AIRETOOL MANUFACTURING COMPANY

Airetool & Yost-Superior Factory Bldgs.
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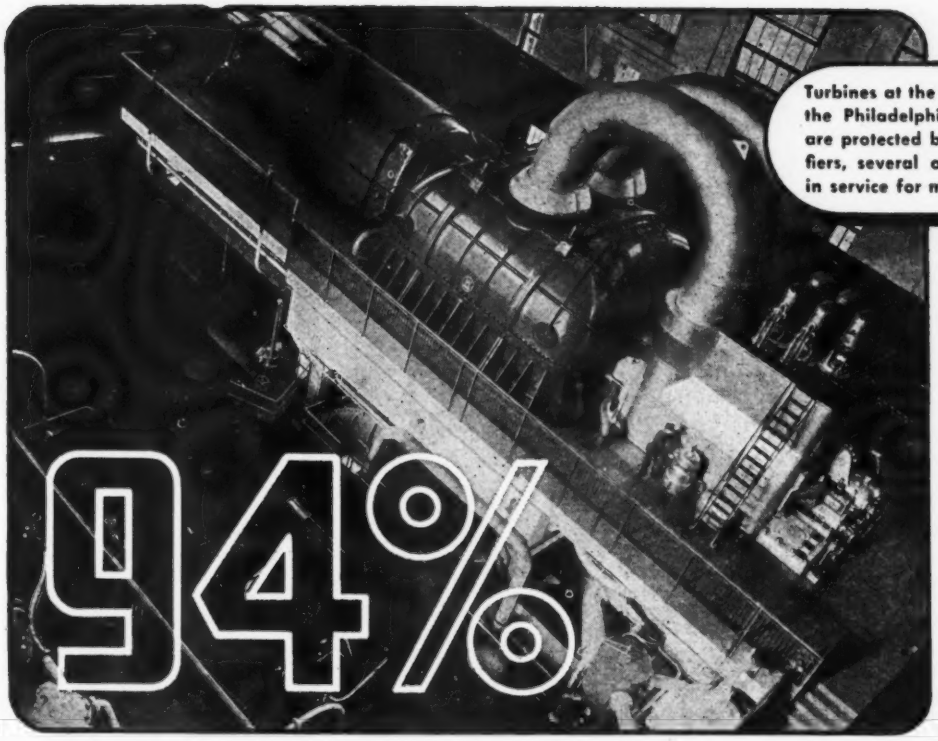


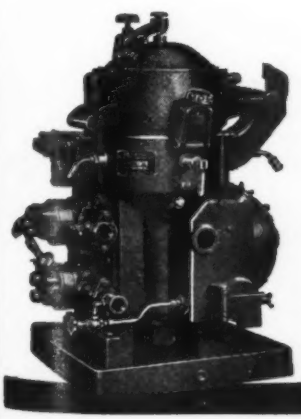
Turbines at the Richmond Station of the Philadelphia Electric Company are protected by De Laval Oil Purifiers, several of which have been in service for many years.

of the LARGEST POWER SYSTEMS *use* DE LAVAL OIL PURIFIERS—

DE LAVAL Oil Purifiers are used by 94% of the largest power systems in this country to maintain the efficiency of turbine lubricating oil or to maintain insulating oil at required high dielectric value, or for both services.

De Laval Oil Purifiers are available as stationary, semi-portable, or fully portable units. "Uni-Matic" self-contained units include Purifier and pumps, heaters when desired, gauges, sampling cocks, etc. A blotter press may be included as an auxiliary for the removal of colloidal carbon from circuit breaker oil. Individual Purifiers are also obtainable in a wide range of capacities. Processing systems, such as the De Laval-Funk method of continuously maintaining the efficiency of turbine oil, are also available.

De Laval Oil Purifiers are *more* efficient, *more* economical, and are supplied in types *more* nearly suited to the needs of the individual plant or system. Hence, they are preferred by *more* companies having need for oil purification equipment. Write for additional details.



THE DE LAVAL SEPARATOR COMPANY
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Our large, modern plant is tooled-up to take care of your Gear orders whether large or small—any quantity—any material—any size. We also produce Sprockets for Roller and Silent Chain Drives.

We are noted for our precision workmanship, minute inspection, quality and dependable service.

P.S. We maintain a large, precision surface grinding department and can offer you time on our production machines. Ask for details.

"Industrial"

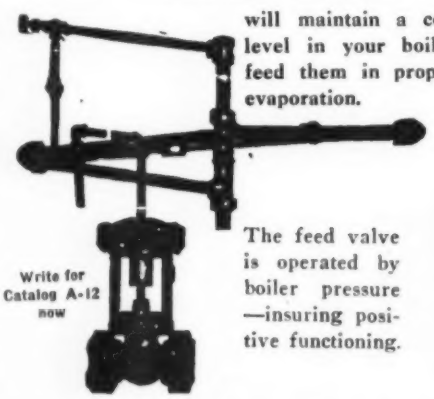
Cut Gears • Cut Sprockets • Cut Racks

INDUSTRIAL GEAR MFG. CO.
4543 VAN BUREN STREET CHICAGO 24, ILLINOIS

For Safe Boiler Operation

The Genuine Squires

Boiler Feed Water Controller



will maintain a constant water level in your boilers and will feed them in proportion to the evaporation.

The feed valve is operated by boiler pressure —insuring positive functioning.

Write for Catalog A-12 now

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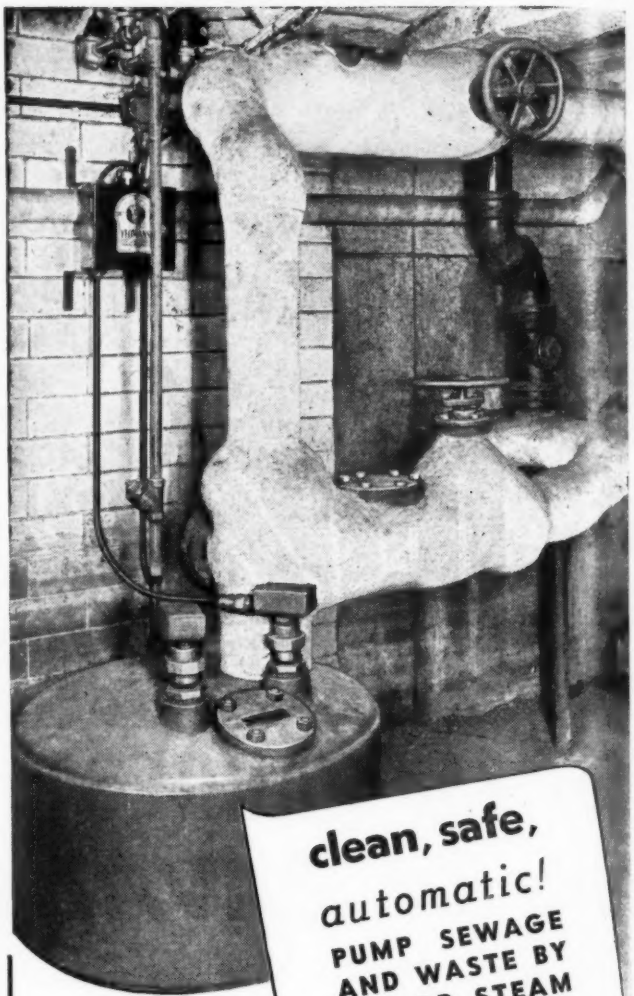

clean, safe, automatic!
PUMP SEWAGE AND WASTE BY AIR OR STEAM

YEOMANS EXPELSOR

This is the modern sanitary way to dispose of sewage, drainage, wastes of all kinds—Yeomans Expelsor, simple, fool-proof, automatic. It does away with the foul wetpit ejector—ends the "clogged pump nuisance" and the revolting task of pump cleaning. The hermetically sealed receiver prevents dangerous gases. No stuffing boxes, no moving parts to require service and attention—literally, no maintenance. Operates by plant air or steam supply. Capacities from 30 g.p.m. up. Easy, inexpensive to install. Write for bulletin 4402—gives complete information.

YEOMANS BROTHERS COMPANY

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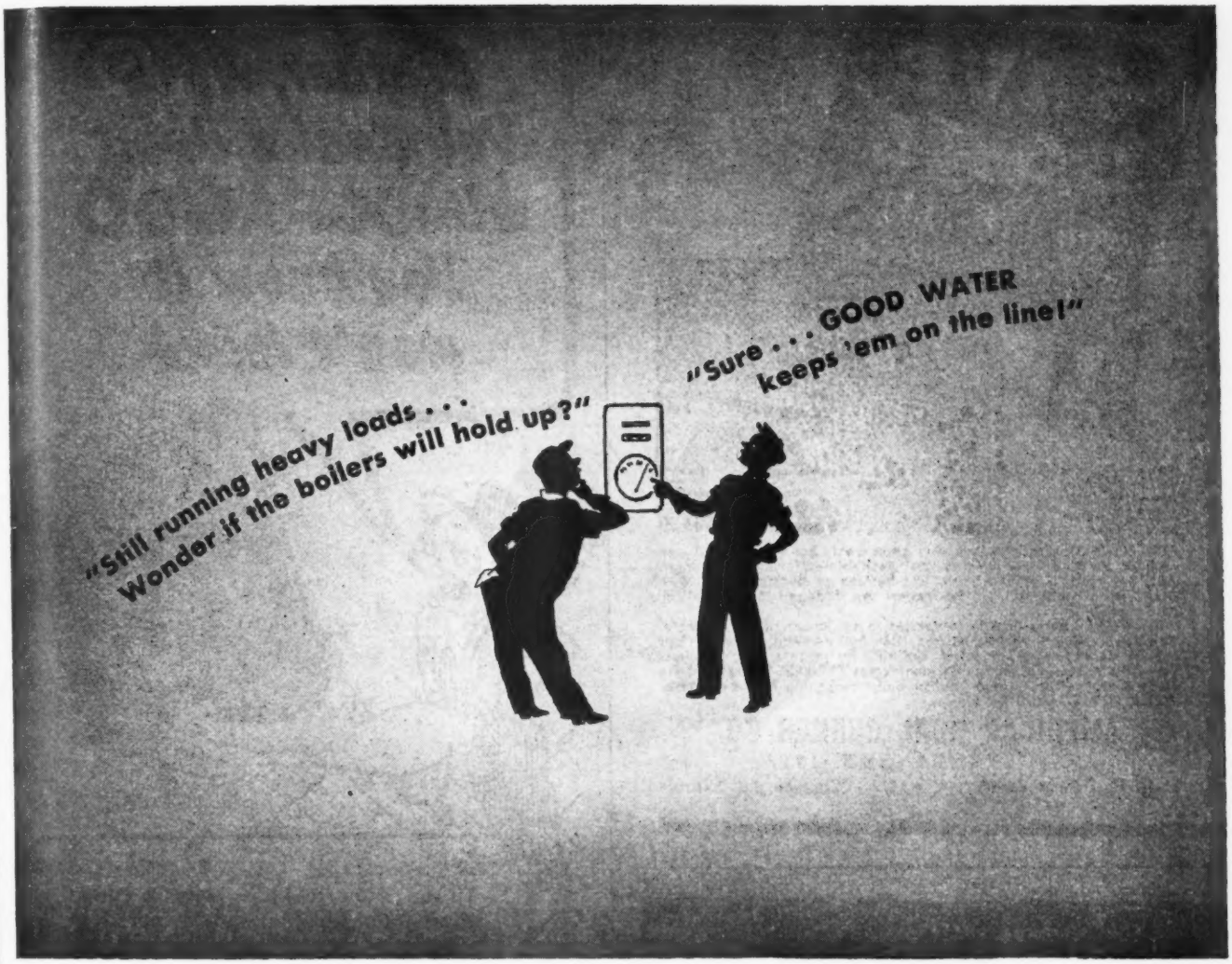

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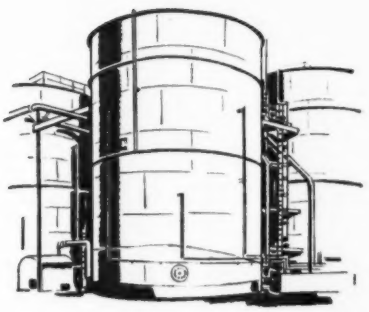

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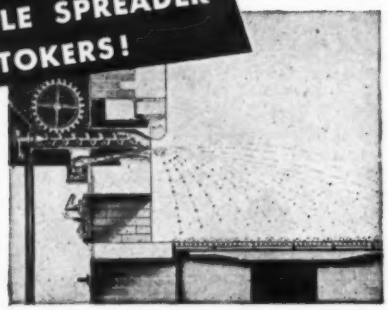

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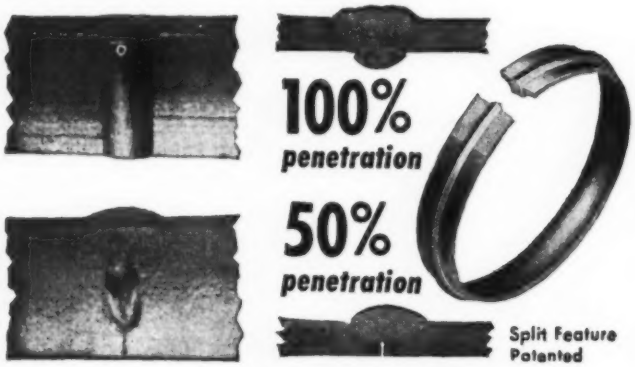

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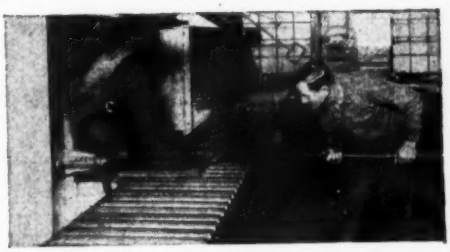

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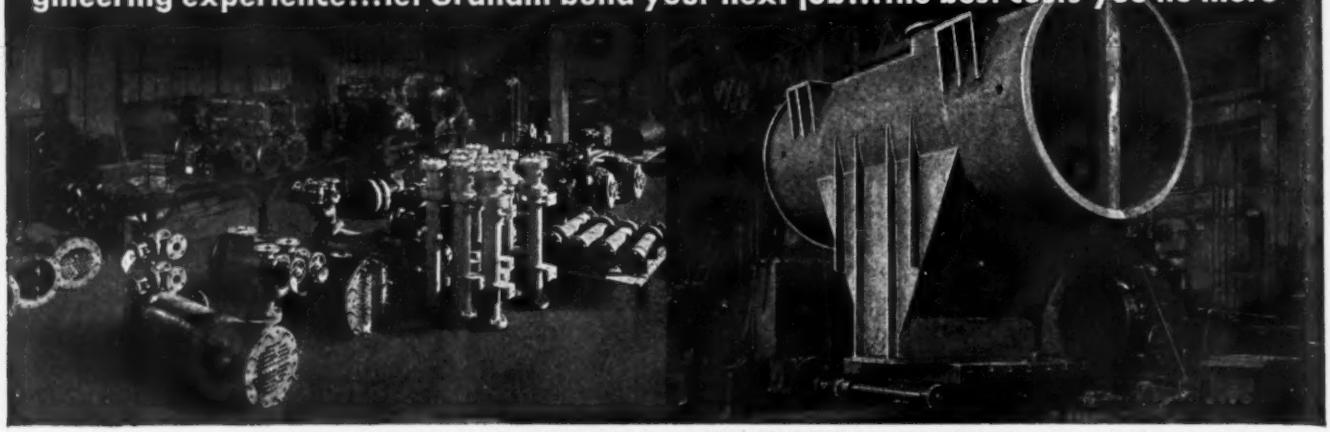

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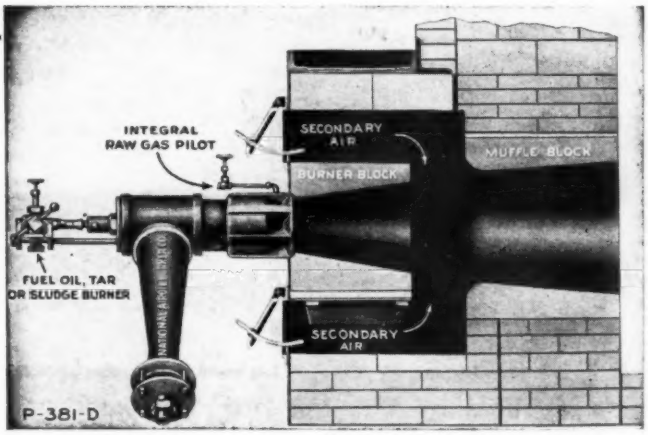

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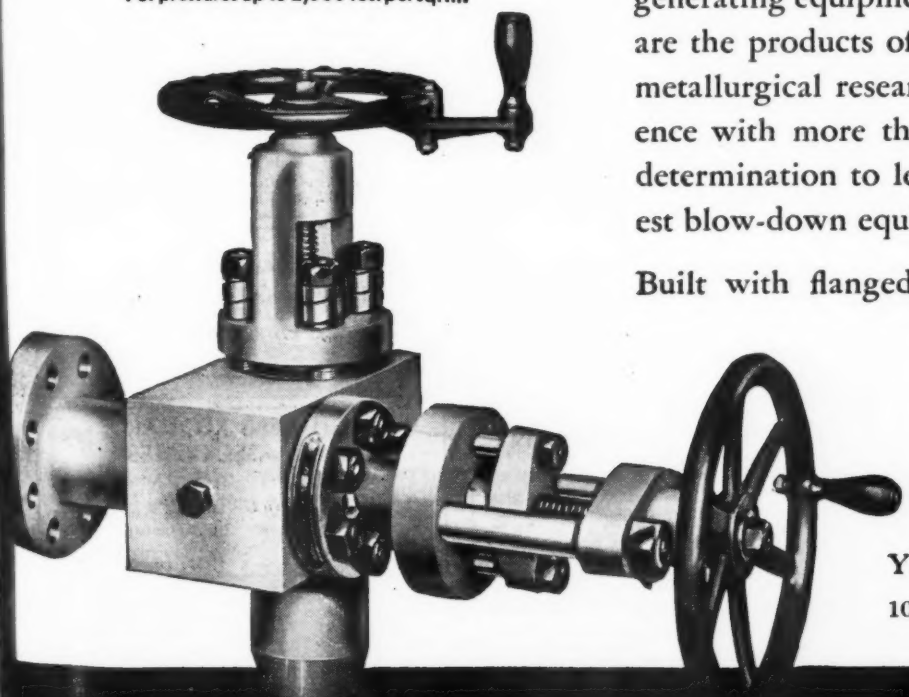

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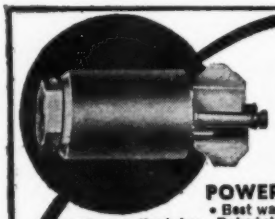
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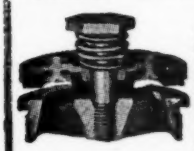
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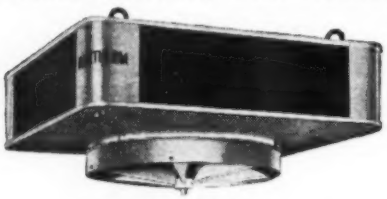

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1—750 KW, 250 volt, Allis Chalmers, synchronous
2—150 KW, 125 volt Westinghouse, synchronous
1—75 KW, 125 volt, General Electric, squirrel cage.
1—20 KW, 600 volt, General Electric, squirrel cage induction motor.
2—15 KW, 250 volt, General Electric, squirrel cage
1—6¼ KW, 125 volt, General Electric, squirrel cage.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chal.

MOTORS—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, Lincoln, 440 volt, slip ring.
1—350 HP, 300 RPM, 440 volt General Electric slip ring.
1—300 HP, 720 RPM, 2200 volt, G.E., slip ring.
1—250 HP, 600 RPM, 4000 volt, G.E., syn.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, General Electric, squirrel cage.
1—150 HP, 1750 RPM, Westinghouse, sl.rg.
2—150 HP, 1200 RPM, 2200 volt Westinghouse, squirrel cage
1—150 HP, 900 RPM, 440 volt, Al. Ch, sl. rg.
1—150 HP, 600 RPM, 220 volt General Electric, synchronous
1—125 KVA, 900 RPM, 220 volt Westinghouse, synchronous
1—100 HP, 900 RPM, 440 volt, G.E., sl. rg.
3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—125 HP, 720 RPM, Allis Chalmers, sl. rg.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.

SPECIAL

1—1000 Gallon GPM Worthington fire pump with 100 HP, 440 volt General Electric motor.

MOTORS—3 PHASE 60 CYCLE (Con't)

2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whlr., sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, G.E., sq. cg.
1—75 HP, 720 RPM, 440 Volt, Westghse., slip ring.
1—75 HP, 720 RPM, 440 volt, G.E., sq. cg.
2—75 HP, 1200 RPM, 2200 volt, G.E., Vertical.
1—50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1—50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS—D.C. 230 VOLTS

2—450 HP, G.E., 400 RPM, Type MPL Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, Westghse., 550 RPM, Type SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1—75 HP, G.E., 675 RPM, Type C, Sprague; with spare armature.
1—65 HP, 1000 RPM, G.E., Type RC.
8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.
1—65 HP, G.E. 625 RPM Type DLC—65, Form A.
1—50 HP, 750 RPM, Westghse., Type SK.
1—50 HP, 700 RPM, Crocker-Wheeler.
1—40 HP, G.E.-Sprague, 700 RPM, Type LC.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, G.E.
1—30 HP, 750 RPM, G.E., type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
130 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—25 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
3—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-13, Form A.
1—15 HP, G.E., 800 RPM, Type RC-11.

TRANSFORMERS

2—400 KVA, G.E., 4156-250/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—150 KVA, G.E., 33,000/2300/4000 Y.
4—150 KVA General Electric, 2200/220/440 volts
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200-250 volts.
3—100 KVA Allis-Chalmers, 2200/220/110 volts
3—75 KVA, G.E., 13,500-750/440 volts.
3—75 KVA, General Electric, 2200/220/110.
1—75 KVA, G.E., 3 phase, 4156Y—120/208Y.
3—50 KVA, G.E., 2200/220/110
2—50 KVA, Pbgh. 7500/15000 volts-110/220 volts.
3—37½ KVA, G.E., 2200/220/440.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
7—25 HP, Westinghouse, 650/2200 RPM. Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

TURBO-GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v., con.
1—200 KW, G.E., 3 ph., 60 cy., 220 v., cond.

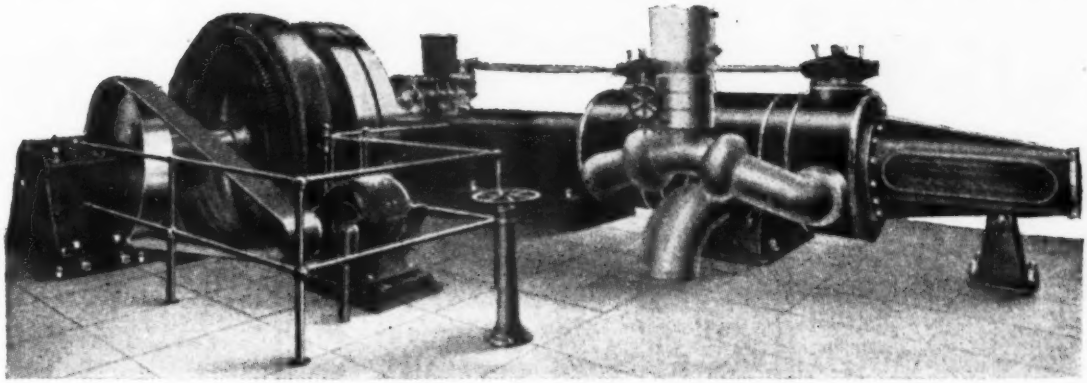
Hemphill FOR POWER

J. L. HEMPHILL & COMPANY

1602 53rd ST., NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227 NEW JERSEY—UNION 3-2600

ELECTRICAL POWER MACHINERY



450 KVA UNIFLOW ENGINE GENERATOR SET

450 KVA General Electric generator, 3 phase 60 cycle 480/240 volts 150 RPM direct connected to Ames uniflow steam engine, 150 lbs. initial pressure, 5 lbs. back pressure, 150 RPM. Complete with auxiliaries.

ENGINE GENERATORS

3 phase 60 cycle

675 KVA BURKE-NORDBERG uniflow, 175 lbs. 15 lbs. back pressure, 2300 volts.

210 KVA GENERAL ELECTRIC engine type generator 2300 volts, 225 RPM.

188 KVA CROCKER WHEELER SKINNER counterflow 125 lbs. 5 lbs. back pressure, 208/120 volts 4-wire.

125 KVA GENERAL ELECTRIC HARRISBURG corliss 125 lbs. 5 lbs. back pressure, 240/480 volts.

ENGINE GENERATORS

250 volts D.C.

500 KW CROCKER WHEELER AMES 4 cylinder vertical uniflow 150 lbs. 4 lbs. back pressure.

400 KW CROCKER WHEELER SKINNER uniflow 150 lbs. 5 lbs. back pressure.

TURBO GENERATOR 250 volts D.C.

500 KW GENERAL ELECTRIC automatic extraction 150 lbs. 0-28 lbs. extraction with surface condenser.

TURBO GENERATORS

3 phase 60 cycle

6250 KVA WESTINGHOUSE condensing, 200 lbs. 2300 volts with jet condenser.

3750 KVA GENERAL ELECTRIC condensing 200 lbs. 2300 volts with surface condenser.

1250 KVA ALLIS CHALMERS condensing, 150 lbs. 2300 volts with jet condenser.

SURFACE CONDENSER

1540 sq. ft. WORTHINGTON surface condenser with steam jet air pumps.

MOTOR GENERATORS

3 phase 60 cycle

1500 KW WESTINGHOUSE synchronous, 250 volts D.C., 6900/12000 volts A.C. 360 RPM.

1000 KW GENERAL ELECTRIC 3-UNIT synchronous, 125/250 volts D.C., 4000/2300 volts A.C., 720 RPM.

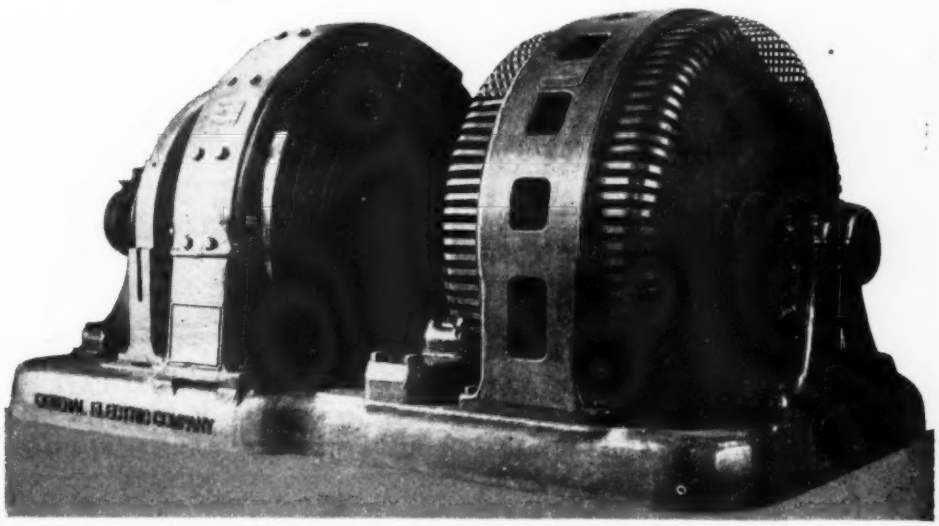
ROTARY CONVERTERS

3 phase 60 cycle

3500 KW WESTINGHOUSE 250 volts D.C., 225 RPM, with 13200 volt transformer.

2500 KW GENERAL ELECTRIC 250 volts D.C., 300 RPM with 4600 volt transformers.

750 KW GENERAL ELECTRIC 600 volts D.C., 1200 RPM with 2300/4000 volt transformers.



1000 KW Motor Generator Set

1000 KW (2) General Electric generators 250 volts, 720 RPM direct connected to 1400 HP General Electric synchronous motors, 3 phase 60 cycle 4150/2300 volts. *Complete with control. Can be shown in operation.*

THE NATIONAL POWER MACHINERY CO.
1921 SCRANTON ROAD — CLEVELAND, OHIO

KIEMLE OF TOLEDO, OHIO

MOTORS
GENERATORS
CONTROLS
TRANSFORMERS
MOTOR GENERATOR SETS
ETC.

BERGER OF ROCHESTER, N.Y.

Put all idle equipment to work. Send your list for prompt action.

TRANSFORMERS

3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300, 1 phase 25 cycle.
1—200 KVA Maloney type H.E. 2400/120/240 volts, 1 phase 60 cycle.
1—200 KVA GE, type H.K. 2300/115/230 volts, 1 PH. 60 cy.
2—150 KVA Pittsburgh, 2300/115/230 volts, 1 PH, 60 cy.
2— 75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.
OTHER SIZES, VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

250 K.W.—(312 KVA) Gen.-Elect., Type A.T.I.—2300/4600 Volt, 60 cycle 150 R.P.M. P. F. .08 with separate belted exciter.
240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle 3 phase, 450 R.P.M. with direct connected exciter.
200 KW Westh. Unity Power Factor, 3 PH. 60 cyc. 900 R.P.M. with direct connected exciter.
150 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts, 600 R.P.M. Revolving field with direct connected exciter.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 R.P.M., revolving field, built-in exciter.
150 KW Elect. Mach. Revolving fields 3 ph. 25 cy. 440 volts 750 R.P.M.

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V, 600 R.P.M.

MOTOR GENERATOR SETS

Western Elect. 1000 Amps—40 volts direct con. to either AC or DC 580 RPM Motor.
Gen.-Elect—100 KW. 3 brg. 125 volts D.C. Comp WD-Int. with 220/460 volts. Sq. Cg. Motor.

CRANE MOTORS

75 H.P.—G. E. 51—230 Volts—550 RPM
35 H.P.—G. E. Form D—550 Volts—590 RPM

FREQUENCY CHANGERS

ALL SIZES VOLTAGES AND CYCLES

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle 750 speed with transformers for 2300 volts to 230 volts D.C.

3 ph. 60 cy. A. C. MOTORS

H.P.	Make		Type	Speed	Volts
300	Ideal	Syn.	P.F. .08	900	4000
200	West.	Syn.-Dir.-Con. Ex.	P.F. .08	900	220/440
200	Wsghse.	Sl.Rg.	CW	600	220/440
200	Wsghse.	Syn.	Dir. Con. Exc.	600	2300
200	Gen. Elec.	Syn.	ATi	514	4000/2300
150	Gen. Elec	Sq. Cg.	I. K.	600	2300
150	Al Ch	Sq. Cg.		600	440
150	Burke	Sq. Cg.	3 BRG. 2 ph.	900	220/440
125	Gen. Elec.	Sq. Cg.	I K	720	220/440
25	Gen. Elec	Sq. Cg.	I. K. Vert.	720	220

3 ph. 25 cy. MOTORS

H.P.	Make		Type	Speed	Volts
350	Gen. Elec.	Sl. Rg. 3 Brg. I		375	440
250	Ideal	Syn.		375	4000/2300
200	Lincoln	S. R.	I. X. W.	500	440
150	Gen. Elec.	Sl. Rg.	I Form M	500	2200
100	Wagner	Sl. Rg.	BR	750	220/440
100	Gen. Elec.	Sl. Rg.	I Form M	750	220/400
100	Gen. Elec.	Sq. C.	I K	750	220/440
100	Wsghse.	Sq. C.	CS	500	220/440
75	Gen. Elec.	Sl. Rg.	I M	750	220/440
75	Wagner	Sq. C.	BM	750	2200
75	Gen. Elec.	Var.	BTA 375/750	440	
75	Gen. Elec.	S.R.	I.M. 17B	160	440

230 D. C. MOTORS

H.P.	Make	Type	Speed
150	West	SK 180L Comp. Wd. Int.	1150
100	Northwestern	K30 Comp. Inter.	1750
85	Gen. Elec.	Vert. Comp. Wound	700
75	Crocker Wh.	CCM25JA	1700
60	Sprague	D—Comp. Wound	625
50	Gen. Elec.	C. L. 6 Shunt Wound	560
40	Fair. Morse	Ball BRG. Vert. Comp.	1740
35	West	SK 150—Shunt Int 550 volts	850

Only partial listing

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY FROM EITHER ROCHESTER, N. Y. OR TOLEDO, OHIO REBUILT AND SOLD WITH A STANDARD NEW GUARANTEE.

Write or wire your inquiries

BERGER BROTHERS
ELECTRIC MOTORS, Inc.
395 STATE ST.
ROCHESTER NEW YORK

The Mark of Dependability

THE FRED W.
KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO OHIO

How the Policy of BELYEA Protects You—*the buyer*

(2) The purchase of conservatively-rated equipment always leads to satisfied buyers. The operation of other equipment, that merely "gets-by", as compared with equipment that really "does-the-job", almost without exception involves one or more of the following unsatisfactory requirements:

1—Highly trained or skilled operator.
2—High maintenance cost.
3—Loss of production due to shut down for repairs.
4—Constant worry for the management.
5—Short life and thus replacement.

It is the realization of these facts that causes the Belyea Company to make conservative recommendations at all times.

This point in the company's policy has probably been one of the greatest factors in the success of RE-NU-BILT equipment.

Remember this—you get a guarantee of successful operation with all **RE-NU-BILT** equipment.

(1) ANALYSIS OF YOUR PROBLEMS

(2) CONSERVATIVE RECOMMENDATIONS

(3) CONSISTENT STANDARDS OF REBUILDING & TESTING

(4) TIME SAVING DELIVERY SCHEDULES

(5) REASONABLE PRICE POLICY

MOTOR GENERATOR SETS

3 phase—60 cycle

1—1500 KW, Whse. 250 v D.C. to 2100 HP, 2300/4600 v syn.

1—1500 KW, G.E. 275 v D.C. to 2100 HP, 2300 v syn.

1—1000 KW, Whse. 600 v D.C. to 1400 HP, 4000 v syn.

1—1000 KW, G.E. 275 v D.C. to 1400 HP, 2300 syn.

1—600 Kva, G.E. 330 KW, 220/440 v A.C. Gen. to 500 HP, 230 v D.C. motor

1—500 KW, G.E. 600 v D.C. to 700 HP, 13200/6600 syn. with exciter

1—500 KW, G.E. 275 v D.C. to 1000 Kva, 2300 v syn. with exciter

1—400 KW, G.E. 275 v D.C. to 700 HP, 2300 v syn. with exciter

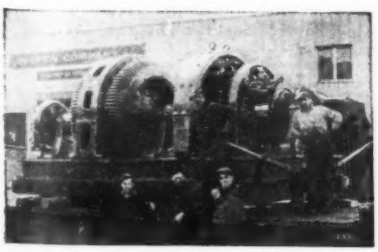
1—75 KW, G.E. 125 v D.C. to 120 HP, 2300/4000 v sq. cg.

1—50 KW, G.E. 125 v D.C. to 75 HP, 2300/4000 v sq. cg.

1—40 KW, Whse. 230 v D.C. to 45 Kva, 2300 v syn.

1—35 KW, Whse. 125 v D.C. to 50 HP, 2300 v sq. cg.

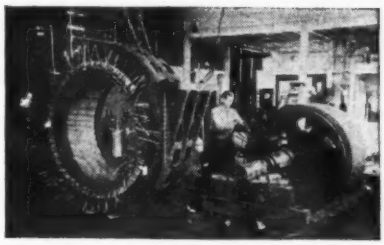
1—25 KW, G.E. 125 v D.C. to 40 HP, 230 v sq. cg.



FREQUENCY CHANGERS

1—75 KW, G.E., with 94 Kva .8 PF, 240 volt, type ATB, 3 phase, 63⅓ cycle gen. and 125 HP, 440 volt, 3 phase, 25 cycle motor

1—1000 KW, G.E., with 1250 Kva, .8 PF, AQB, 2300 volt, 2 phase (can be changed 800 KW, 3 phase), 58.3 cycle gen. and 1400 HP, .8 PF, 4400/2200 volt, ATI, 3 phase, 25 cycle motor and exciter



A C MOTORS

3 phase—60 cycle

SLIP RING

Qua.	Hp.	Make	Type	Volts	Speed
1	1200	Cr. Wh.	801Q	2300	237
2	1000	Whse.	CW	2300	720
1	800	Al. Ch.	ANY	440	885
1	800	Whse.	CW	440	357
2	600	G.E.	IP	440/2200	720
1	600	G.E.	MT	550	220
1	450	Whse.	HF	2200	875
1	400	G.E.	IP	2200	252
1	400	Al. Ch.	ANY	2300	505
1	400	G.E.	IP	440/2200	600
1	350	G.E.	MT-442Y	2200/4000	253
1	300	G.E.	IM	440	720
1	300	Whse.	CW	440	585
1	250	G.E.	MT-424Y	4000	257
1	200	G.E.	IM	440	600
1	200	Whse.	CW	2200	514
1	150	G.E.	I-17B	2200	290
1	150	Whse.	CW-772C	2200	1160
1	150	G.E.	IM-16	2200	575
1	150	G.E.	IM-17	2200	450
1	100	G.E.	IM	550	720
2	100	G.E.	IM	2200	575
1	100	G.E.	MTC	550	685
1	100	G.E.	IM	220	1750

SQUIRREL CAGE

Qua.	HP	Make	Type	Volts	Speed
1	500	G.E.	IK-17B	2200	690
1	300	Whse.	CS	550	580
1	300	G.E.	IK-17B	550/440	600
1	200	G.E.	IK-17B	2200	490
2	175/112	G.E.	IK-16	440	900/720
1	125	Whse.	CS	550/220	1150
1	100	G.E.	IK-Vert.	2300	450

ROTARY CONVERTERS

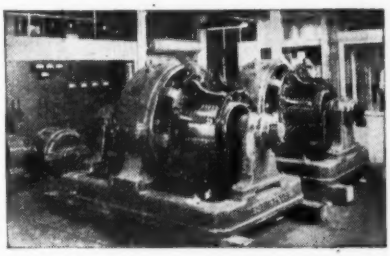
3 phase—60 cycle

Qua.	KW	Make	Speed	DCv	Trans V
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	260	2300
1	1000	G.E.	900	600	13200
1	1000	Whse.	900	600	11000
1	1000	Whse.	720	250	22000
2	750	G.E.	1200	600	2300
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/6600
2	375	G.E.	1200	250	6600/2300

3 phase—25 cycle—Booster Type

1	1500	G.E.	500	225/275	13200/6600
1	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC Panels.



D. C. MOTORS

Qua.	HP	Make	Type	Volts	Speed
2	1250	G.E.	MPC	500	130
1	1200	Whse.	Int.	600	600/720
1	1200	G.E.	MPC	600	450
1	800	G.E.	MPC	550	600
2	625	G.E.	MPC	500	130
1	500	Whse.	Int.	250	250/720
1	500	G.E.	MPC	230	900
2	300	G.E.	DMC	230	400/600
1	300	G.E.	MPC	230	275/550
1	250	Al. Ch.	Int.	230	525
1	175	Whse.	SK	250	150/525

RE-NU-BILT BELYEA MOTORS

SUCCESSFUL OPERATION GUARANTEED

BELYEA COMPANY INC.

Main Office & Shop: **43 HOWELL ST., JERSEY CITY, N. J.**

L. J. LAND AND COMPANY

Dependable Electrical Equipment for War and Peace time Production

DIRECT CURRENT

(Partial List Only)

230 VOLT DC MOTORS

H.P.	Make	Speed
60	El. Dynam.	900
60	Roth	600
60	G.E.	480/1100
50	West.	550/1100
50	Cr. Wh.	700 (2)
50	G.E.	850
45	Diehl	850/1020
40	El. Dy.	1200
40	Cr. Wh.	915
35	West.	1150
25	Diehl	850/1020
25	G.E.	1150
25	G.E.	575
20	R & M	1160
20	G.E.	1150
20	West.	1150
20	G.E.	800 (2)
15	West.	1250
15	G.E.	1150
15	Cr. Wh.	900/1800
15	West.	850
10	West.	850
10	G.E.	825
10	G.E.	700
10	Al. Ch.	600/1800
10	West.	600/1200
10	G.E.	400/1600
10	West.	400/1200
9	G.E.	450/1800
8½	Diehl	900
8½	West.	850
8½	West.	350/1400
7½	Sturt.	3600
7½	Peerl's	1700
7½	West.	1450
7½	West.	1150 (2)
7½	G.E.	1150
7½	West.	975
7½	Al. Ch.	850
7½	El. Dy.	550/1650
7½	Watson	525/1150
7½	G.E.	400/1600
7½	West.	400/1600
7½	Al. Ch.	350/1050
7½	G.E.	300/1200
6	G.E.	400/1200
6	G.E.	450/1800 (2)
5½	West.	500/1500 (2)
5	West.	850
5	G.E.	900 (2)
5½	G.E.	400/1600
5	West.	1800
5	G.E.	1700
5	G.E.	1150 (2)
5	West.	1100
5	Al. Ch.	1150
5	Cont.	600/1800
5	West.	850
5	G.E.	850
5	Star	600/1200
5	El. Dy.	550/1650
5	G.E.	450/800
5	G.E.	600
5	G.E.	450/1350
5	West.	400/1200
5	El. Dy.	275/1100
4	G.E.	850/1150
3½	West.	850/1600
3	West.	1700
3	West.	1150 (6)
3	Roth	500/2000
3	G.E.	500/1500
2½	West.	480/1800

236 additional 230 volt D. C. Motors in stock as small as 1/20 H.P.

115 VOLT DC MOTORS

H.P.	Make	Speed
90	G.E.	900
20	West.	200/900
15	West.	1100
15	Cr. Wh.	800
10	L. Allis	3500
10	West.	850
10	El. Dy.	425/1275
7½	G.E.	850 (2)
6	Burke	650
5	Cr. Wh.	1875
5	West.	1100 (2)
5	Cr. Wh.	960

75 additional 110 volt Motors down to 1/6 H.P.

BELTED AND MOTOR DRIVEN DC GENERATORS

100 KW West.	125 volts
100 KW West.	250 volts
75 KW West.	250 volts
60 KW G.E.	600 volts
60 KW G.E.	125 volts
50 KW West.	125 volts
45 KW West.	250 volts
30 KW El. Dy.	600 volts
40 KW Cr. Wh.	125 volts
30 KW West.	125 volts
25 KW West.	125 volts
25 KW G.E.	250 volts
20 KW G.E.	125 volts
15 KW West.	125 volts

43 additional Motor Generator Sets, 30 volts, 60 volts, 125 volts, 250 volts, and 250 volts as small as ½ K.W.

ALTERNATING CURRENT

(Partial List Only)

2 & 3 PHASE SLIP RING

H.P.	Make	Speed
250	G.E.	600
125	Burke	580
112	G.E.	900
100	F. M.	690
75	West.	1170
75	Al. Ch.	575
64	G.E.	585
60	West.	1135
60	West.	290
50	G.E.	870 (2)
50	West.	850
40	Wagner	1150
40	F. M.	870
40	West.	870
40	Linc.	690
30	G.E.	870
30	G.E.	690
15/35	West.	6/1200 (5)
25/55	G.E.	6/1200
20/50	West.	6/1200
25	Al. Ch.	870 (2)
25	West.	850
25	G.E.	870 (2)
25	G.E.	720
25	West.	575
20	G.E.	870
20	West.	575

116 additional Slip Ring Motors in stock down to ½ H.P.

3 PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
200	G.E.	600
150	G.E.	860
147	West.	715
100	G.E.	1200
100	G.E.(BTA)	375/750
75	West.	870
50	West.	1200
50	G.E.	900
50	G.E.	3600
40	G.E.	900
35	Wagner	850
30	U. S.	3450 Vert.
30	West.	1750
30	Al. Ch.	514
25	Wagner	1200
25	West.	1140
25	Diehl	865
25	G.E.	900
25	Wagner	720
20	G.E.	1750
20	G.E.	1200
20	Cr. Wh.	1200
20	Al. Ch.	900
20	Diehl	900
20	G.E.	720
20	West.	1720

29—15 H.P. 4 speed 600/900/1200/1800 RPM Constant H.P. Motors

15	Cr. Wh.	1700
15	G.E.	1200
15	Wagner	720
15	G.E.	600
10	G.E.	720
10	G.E.	3450
10	West.	1150

325 additional three phase Motors down to ¼ H.P.

TWO PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
50	Linc.	900
50	G.E.	900
40	G.E.	900
40	Al. Ch.	900
35	Al. Ch.	900
30	West.	1200
25	G.E.	1200
20	West.	1150
15	G.E.	1200
15	F & M	900
10	G.E.	1200
10	G.E.	900
7½	G.E.	900
7½	G.E.(BQS)	600/1350
5	G.E.	900
5	Al. Ch.	1200

146 additional two phase Motors down to ¼ H.P.

SINGLE PHASE MOTORS

H.P.	Make	Speed
20	Wagner	1160
20	Cent.	1165
7½	Cent.	3500

AC GENERATORS

150 KW G.E.	720
125 KW Cr. Wh.	900
100 KVA West.	600
60 KW West.	1200
25 KVA West.	1200

New York City's Largest Stock Electrical Machines

ESTABLISHED 1910

SOLD WITH A ONE-YEAR GUARANTEE

SPECIALS

1000 Ampere 60 Volt
CHANDEYSSON
Synchronous Motor Driven
D.C. GENERATOR
450 RPM—3 ph 60 cy 220 Volt
Complete with starter & Panel Board

Also

1000 ampere 6 Volt Plater
Chandeysson Synchronous
Motor Driven
600 RPM 3/60/220V.

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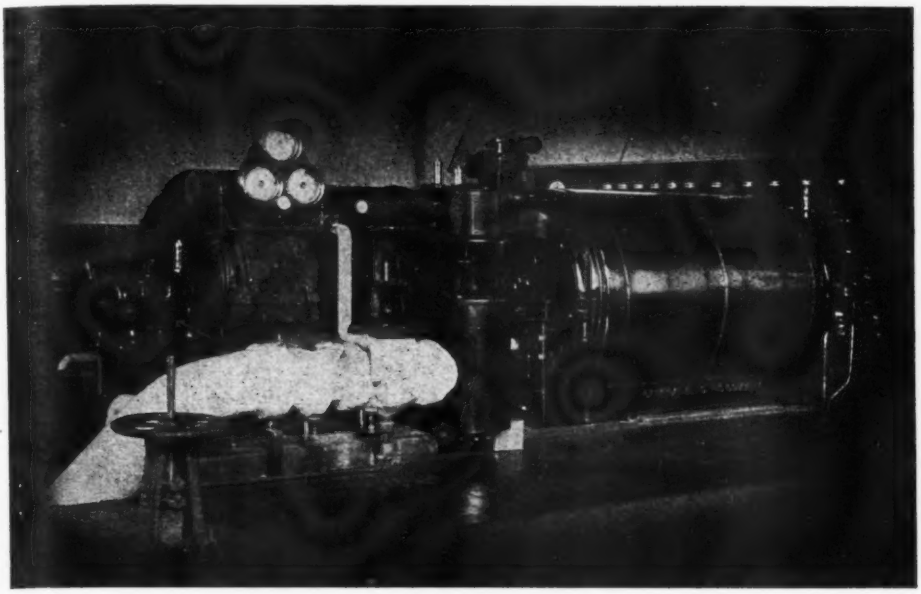
Office
Reading, Penna.
10th & Exeter Sts.

Office
York, Penna.
323 E. Market St.

3125 KVA CONDENSING TURBINE-GENERATOR UNIT



ACTUAL PHOTOGRAPH

AVAILABLE IMMEDIATE DELIVERY

3125 KVA — 2500 KW 80% P.F. General Electric, 3 phase, 60 cycle, 2300 volt, 3600 RPM condensing turbine-generator unit, 180-200# I.S.P. 500° T.T., equipped with surface condenser, panels and instruments.

Excellent condition—a complete installation.

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

1875 KVA G.E. condensing 175-200 lb. pressure, 500° T.T. 6600 volts, 3600 RPM complete with condenser.

937½ KVA G.E. automatic extraction condensing, 175 lb. pressure, 125°F. superheat, 15 lb. gauge, 2300 volts, 3600 RPM—complete.

750 KVA G.E. non-condensing, 175-200 lb. pressure, 15 lb. back pressure, 480 volts, 3600 RPM, complete with switchboard.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

375 KVA G.E. non-condensing, 150-175 lb. pressure, 5 lb. back pressure, 2300 volts, 3600 RPM each complete with direct connected exciter.

125 KVA G.E. non-condensing, 110-125 lb. pressure, 0-10 lb. back pressure, 240 volts, 3600 RPM complete with switchboard.

ROTARY CONVERTERS

1500 KW Westinghouse synchronous 250 volts, direct current—6 phase, 60 cycle alternating current, 514 RPM.

ENGINE-GENERATOR UNITS

Direct Current

1000 KW Westinghouse, 250 volts, 514 RPM generator direct connected through reduction gear to Westinghouse condensing turbine, 150-200 lb. pressure, equipped surface condenser.

600 KW Crocker-Wheeler, 250 volts, 300 RPM generator direct connected to a 14" x 18" 4 cylinder Ames vertical Unaflow non-condensing engine, 150-175 lb. pressure, 5 lb. back pressure, complete with switchboard.

350 KW G.E. 250 volt, 175 RPM generator direct connected to a 28" x 28" Skinner Universal Unaflow non-condensing engine.

125 KW, 125 volt, 250 RPM generator direct connected to 18" x 16" Elliott engine, 100 lb. pressure, 10 lb. back pressure, complete with switchboard.

75 KW 125 volt, 1800 RPM Westinghouse direct current non-condensing turbine-generator unit.

75 KW, 125 volt, 2400 RPM Allis Chalmers-Terry noncond. turbine-gen. unit.

15 KW (3) Crocker-Wheeler, 125 volt, 410 RPM generators each direct connected to an American Blower vertical engine.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle Alternating Current

375 KVA G.E. 2300 volts, 200 RPM generator direct connected to a Chuse cross compound 4-valve non-releasing Corliss engine.

312 KVA Elliot 4000/2300/550 or 240 volts, 180 RPM generator direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. back pressure.

250 KVA Westinghouse, 2300 or 480 volts, 200 RPM generator direct connected Nordberg Unaflow engine.

150 KVA Allis 240 volt, 225 RPM generator direct connected Skinner Universal Unaflow engine.

MOTORS

—3 phase, 60 cycle

900 HP G.E. 240 volts, 900 RPM synchronous.

500 HP 80% P.F., G.E., 240 volts, 900 RPM synchronous motor with direct connected exciter.

500 HP Westinghouse 2200 volt, 1750 RPM squirrel cage induction.

125 HP 80% P.F. Elec. Mchy, 440 volts, 400 RPM synchronous.

60 HP G.E. 220 volts, 900 RPM squirrel cage induction complete with starting compensator.

50 HP G.E. type I, form M, 2200 volts, 1200 RPM slip ring.

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

SYN. MOTORS
3 phase, 25 cycle

1700 HP G.E. 2300 volts, 300 RPM.

910 HP Westgh. 2300 volts, 300 RPM.

MOTOR GENERATOR SET

1500 KW Allis-Chalmers, 600 or 275 volt direct current generator direct connected to 2190 HP, 3 phase, 60 cycle, 4000/6600 volt, 300 RPM synchronous motor.

FREQUENCY CHANGER SETS

750 KVA Westinghouse, 3 ph., 60 cy., 2300 v. alternating current generator dir. con. to 910 HP, 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

1200 KVA General Electric, 3 ph., 60 cy., 2400 v. alternating current generator dir. con. to 1700 HP, 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

SPECIAL OFFERINGS

500 KVA G.E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

350 GPM, 720' head, 5 stage Allis-Chalmers centrifugal pump direct connected to 125 HP, 3 phase, 60 cycle, 2200 volt, 1750 RPM motor.

22" x 48" Nordberg Corliss belted type engine, 150 to 175 lb. pressure, 100 RPM.

MODERN SLIGHTLY USED BOILER

500 HP, 250 lb. pressure, A.S.M.E. code, bent tube, water tube boiler complete with stoker and auxiliaries. New 1938.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

FOR SALE

FREQUENCY CHANGERS

1—6875 KVA WEMCO. 13,200/4150 v. 25/62½ cy., 375 RPM.
1—2000 KVA WEMCO. 13,200/4150 v. 25/62½ cy., 375 RPM.

MOTOR-GENERATOR SET

1—1000 KW M-G set, WEMCO. 230/275 v., 295 RPM, 3/60/4400 v.

ROTARY CONVERTERS

1—1200 KW WEMCO. 240/300 v, 187½ RPM, 3/25/13,200 v.
2— 500 KW WEMCO. 240/300 v, 375 RPM, 3/25/13,200 v.
2—2500 KW WEMCO. 245/310 v, 450 RPM, 3/60/13,200 v.

TRANSFORMERS

4—2500 KVA G. E. Power Transformers, 63,500 Y/19,050 Y/2300 V., 1 phase, 60 cycle.
3—4000 KVA WEMCO Power Transformers, 63,510 Y/19,050 Y/2293 V., 1 phase, 60 cycle.

Available Immediately

CONSOLIDATED GAS ELECTRIC LIGHT & POWER COMPANY of BALTIMORE
Purchasing Dept. 531 E. Madison St. Baltimore 3, Md.

HAMILTON 14 x 36

CORLISS ENGINE

Steam driven with 8 foot drive pulley, 24 inch face.

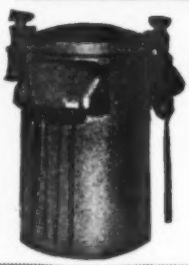
In excellent condition. Discontinued as machinery bought is motor driven.

MELROSE CONFECTIONS CO.
Crease St. above Girard Ave.
P. O. Station K
PHILADELPHIA, PA.

SLIP RING MOTORS
75 HP. 1800 RPM. 3/60/220 Volt Wagner
100 HP. 600 RPM. 3/60/2300 Volt Allis Chalmers
150 HP. 514 RPM. 3/60/220 Volt Allis Chalmers
200 HP. 600 RPM. 3/60/2300 Volt General Elec.
AC GENERATORS
50 KW. 1200 RPM. 3/60/220 Volt Westinghouse
150 KW. 600 RPM. 3/60/220 Volt General Elec.
200 KW. 720 RPM. 3/60/240 Volt General Elec.
VOLTAGE REGULATOR
Gen. Elec. Tirrel Type TA, Form F6 complete
AIR COMPRESSOR
18 x 11 x 14 Sullivan WJ3 complete 150 HP. motor
OIL ENGINES
10 HP., 20 HP. & 25 HP. Fairbanks Morse horiz. type Y
ENGINE GENERATORS
60 KW. 3/60/220 Volt, Westinghouse—Ideal PV
75 KW. 3/60/480 Volt, General Elec.—Skinner 8V

Rockford Electric Equipment Co.
721 South Wyman St. Rockford, Illinois

—TRANSFORMERS—



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We have several thousand transformers in stock for prompt shipment, and invite your inquiries

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

• • CRANE • •

10 ton, Whiting 55' span, 35' lift, cab operated, AC crane, with or without runway, any AC current required.

Immediate delivery.

Phone station to station collect for details, and price.

ELECTRIC EQUIPMENT CO.
Glenwood 6783, 63 Curlew St.
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NEW and USED EQUIPMENT AVAILABLE

for

Power Plants, Sub-Stations, Transmission Lines and Construction

Send for new list..... to

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EBASCO SERVICES INCORPORATED, TWO RECTOR ST., NEW YORK, N. Y.

POWER PLANT

3—200 H.P. Brady Scotch Type, Horizontal, Self Contained, A.S.M.E. Code, 125 lb. Boilers, arranged for coal firing, complete with regular steam trimmings, steel flue, Cochrane Open Type Heater, Boiler Feed Pumps, CO2 Recording Equipment, Damper Regulator and complete Schutte Koerting Oil Fuel System, disconnected.

1—50 K.W. Westinghouse 125 vo. D.C. Generator, 400 amps., 100 R.P.M. to 14" x 30" Wetherill Corliss Engine.

1—75 K.W. Westinghouse 125 vo. D.C. Generator, 600 amps., 100 R.P.M. to 16" x 30" Wetherill Corliss Engine.

1—100 K.W. Westinghouse 125 vo. D.C. Generator, 800 amps., 100 R.P.M. to 18" x 30" Wetherill Corliss Engine.

All in fine condition, ready for prompt shipment.

DELTA EQUIPMENT CO.
148 N. 3rd St., Phila. 6, Pa.

For Sale by Owner

1—B-Line Gas Boiler—Type-2726-SA Input—1591200 BTU. Output—5300-Sq.Ft.

2—B-Line Gas Boilers—Type-1211-S Input—673200 BTU. Output—2240-Sq.Ft.—*Used one month.*

PHILLIPS EXETER ACADEMY
Exeter, New Hampshire

PIPE
CUT TO SKETCH ⅛ to 24"
METROPOLITAN
PLUMBING SUPPLY CO., INC.
INDUSTRIAL AND MARINE SUPPLIES
Large SURPLUS STOCK
STEEL-WROUGHT IRON-CAST IRON
BRASS-COPPER-CEMENT LINED PIPE
Power Plant Valves & Engineering Specialties - Jenkins - Fairbanks & Saroo Valves
313 EAST 31st STREET, N.Y.C.
HOURLY NATION-WIDE SHIPMENTS
FLANGED VALVES & FITTINGS

1—B&W 5016' Stirling Class 0-20, A.S.M.E.—N. Y. Std.—200# with 125° Superheated, Diamond Soot blowers and Riley M.D. Coal Pulverizer Unit.
1—350 HP Union A.S.M.E.—175#, has 2—36" x 24' longitudinal drums, 149—4" x 20' Str. Tubes.

NELSON MACHINERY COMPANY
Green Bay, Wis.
HOME OF THE "PACKERS"

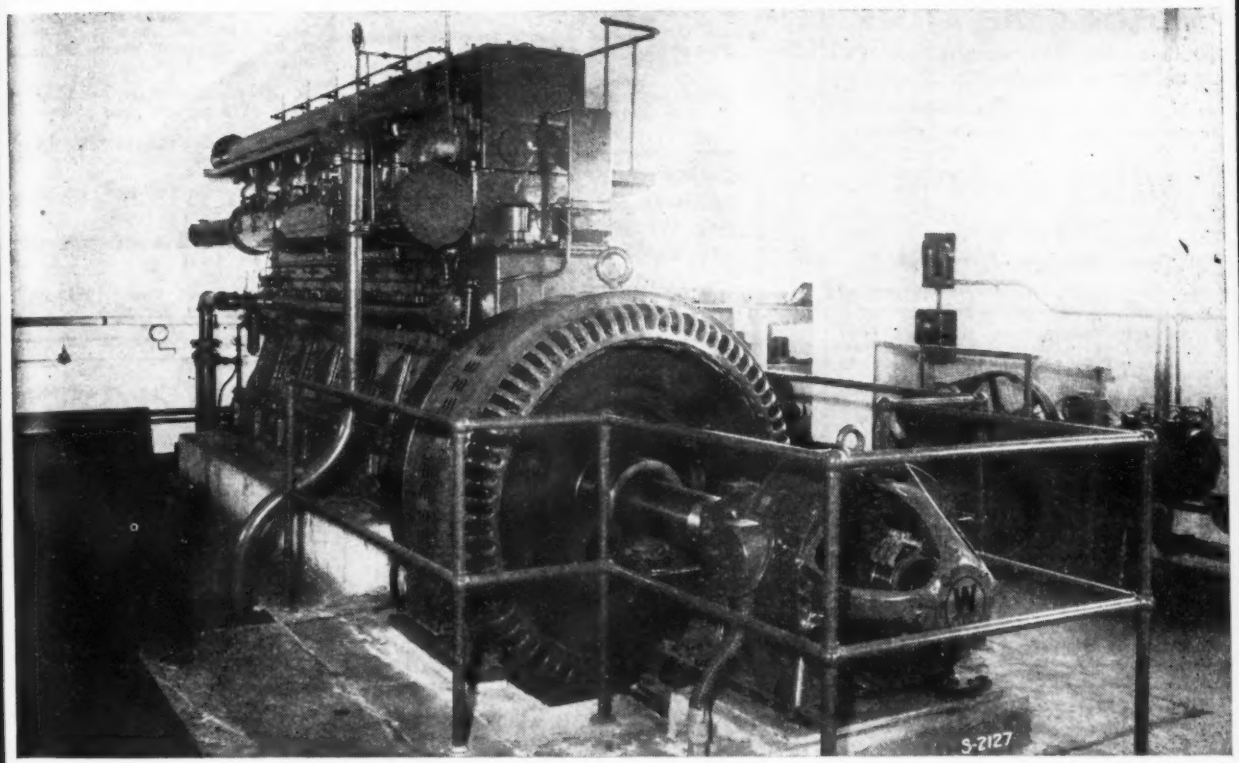
DIESELS

ROBERT SCHOONMAKER
Port Washington, Long Island, N.Y
Phone Roslyn 1220

2175 HP DIESEL PLANT

5 WORTHINGTON DIRECT CONNECTED SETS

DELIVERY TODAY — ONE OR ALL



Actual photograph of Unit Number 3

REBUILT — GUARANTEED

Westinghouse a.c. generators with direct connected exciters and individual switchboards, synchroscope, power factor and recording volt meters and voltage regulator. The engines are modern four cycle Worthingtons with force feed lubrication, overhead valves, solid injection, individual Bosch fuel injection pumps and nozzles. Woodward I. C. hydraulic and Massey governors. Engine auxiliaries include closed jacket water cooling system with heat exchangers, make up tanks, circulating fresh and raw water pumps, valves and fittings. Gasoline driven starting compressors, separate air receivers. Lube oil and fuel strainers, day tanks, pyrometers and thermocouples, oil and water pressure and temperature gauges with alarm shut off. Air intake silencers, exhaust mufflers and piping. Engine and Generator specifications are as follows:—

1—625 HP	Model E	5 cyl.	17	x	25	D.C. to 625 KVA	225 rpm	1933
1—500 HP	Model DD	6 cyl.	13¼	x	17½	D.C. to 431 KVA	360 rpm	1939
1—375 HP	Model D	5 cyl.	13¼	x	17½	D.C. to 312 KVA	327 rpm	1931
1—375 HP	Model E	3 cyl.	17	x	25	D.C. to 312 KVA	225 rpm	1933
1—300 HP	Model D	4 cyl.	13¼	x	17½	D.C. to 250 KVA	327 rpm	1931

ROBERT SCHOONMAKER

DIESEL SALES ENGINEERS

P. O. BOX 232 PHONE ROSLYN 1220

PORT WASHINGTON, L. I.

NEW YORK

SYNCH. CONVERTERS

500 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW WEST 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
150 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

200 KW G.E. IND. 600 V. 2300/4000 A.C. 1200 RPM
200 KW RW SYN. 250 V. 2300/4000 A.C. 900 RPM

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK CO.
Incorporated
502 Grant Building Pittsburgh, Pa.

1—300 HP Venn-Severin Diesel, 4 cylinder, 2 cycle, 327 RPM, with direct connected 250 KVA AC generator, 3 phase, 60 cycle, 240 Volts.
1—100 HP Venn-Severin Diesel, 2 cylinder 2 cycle, 327 RPM.
1—100 HP Venn-Severin Diesel, 3 cylinder, 2 cycle, 435 RPM.
1—60 HP Venn-Severin Diesel, 2 cylinder, 2 cycle, 400 RPM.
1—40 HP Venn-Severin Diesel, 2 cylinder, 2 cycle, 650 RPM.
1—30 HP Venn-Severin Diesel, 1 cylinder, 2 cycle, 400 RPM.

All engines are rebuilt and guaranteed. Installation by experienced erecting man could be arranged in any part of the U. S.

RUDOLF O. LIEFKE
30 Church St., New York 7, N. Y., U.S.A..

STEAM PUMPING ENGINES

1—Snow 8 MGD C&FW Cr. Com. Opp. Type Cond. 26x54x17x36, with waterworks type condenser.
1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20-40x14½x36, with waterworks type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. All fine cond.

PUMP VALVES

Birch Valves for all types of reciprocating pumps.

LARGE GATE VALVES

1—20" Rensselaer #13 Iron Body Bronze Mounted Hub End Gate Valve with 16" Iron Brass Lined Hydl. Cyl. with indicating Rod and Eyebolt. 100#
1—20" Crane 125# Flanged Hard Wheel operating Gate Valve.

BIRCH MANUFACTURING COMPANY
1523 Sedgwick St. Chicago, Ill.

BOILERS

NEW and USED!

All makes & sizes for prompt shipment

2—400 H. P. B & W Stirling Type Boilers 200#
2—100 H. P. Scotch Marine Boilers 100#
3—250 H. P. Scotch Marine Boilers 100#
1—275 K.V.A. Engine Generator Unit
12—Various sizes Vertical Fire Tube boilers

J. F. DAVIS CO.
122 S. Michigan Ave. CHICAGO

FOR SALE

4—New Detroit single retort underfeed unistokers for 150 h.p., h.r.t. boilers with 6' fronts. Active grate area 39 sq. ft. Motor driven for 3 ph., 60 cy., 220 v. current. Complete with blowers, etc., for 200% rating.

LIBBY, McNEILL & LIBBY
CHICAGO

1—400 HP Westinghouse, type CW, 3 ph. 60 cy, 440V, 450 RPM slip ring motor

1—300 HP, General Electric, 3 phase, 60 cycle, 440 volt, 360 RPM, type MT 412 slip ring motor

1—150 HP General Electric, 3-60-440V frames 17A 360 RPM slip ring

1—150 HP Westinghouse, 2 ph, 60 cy, 440V frame 1000, CW. 390 RPM slip ring

4—100 HP General Electric, 3-60-440V, 495 RPM, MT 562 slip ring

2—100 HP General Electric type I, form K, 3-60-220V 575 RPM

1—75 HP, General Electric, 3 phase, 60 cycle, 440 volt, 450 RPM, type I, form M, slip ring motor

2—800 HP, 3 PH, 60 CY, 6600 V Westinghouse, type CW, slip ring 507 RPM mill type motors with liquid slip regulators.

1—150 HP DC Westinghouse, type SK, frame 666.3, 600 V, 360/720 RPM ped. type mill motor, #4798360.

1—100 HP Westinghouse, type CCL, 3 ph, 60 cy, 2200V, 1750 RPM, Squirrel Cage

1—100 HP Allis-Chalmers, type ANY, 3 ph, 60 cy, 220V, 580 RPM slip ring

1—100 HP General Electric, 3 ph, 60 cy, 4000V, 720 RPM syn., type TS with direct connected exciter

2—100 HP Crocker Wheeler, size 2AQ, 3 ph, 60 cy, 440V, 385 RPM slip ring

1—100 HP Westinghouse, type CS, 3 ph, 60 cy, 440V, 1750 RPM sq. cage

2—75 HP 300 foot head Pumps: 2200V Fairbanks-Morse, 1800 RPM 3 ph, 60 cy, slip ring motors direct connected to 500 GPM 3 stage

1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V 450 RPM slip ring

1—75 HP Fairbanks-Morse, type H, frame 165C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage

1—75 HP Lincoln, type IQ, 2 ph, 60 cy, 440V, 600 RPM Squirrel Cage

1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 600 RPM slip ring

2—75 HP Allis Chalmers, 3 ph, 60 cy, 440V, 860 RPM slip ring

1—60 HP Lincoln 3-60-220V frame IXM, Sq. Cage, 900 RPM

1—60 HP General Electric, 3-60-440V, 720 RPM, type I, form K

1—60 HP General Electric, 3-60-440V, 1750 RPM, type I slip ring

1—50 HP Wagner (Fynn Weichsel) 3-60-440V, 1200 RPM

1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring

2—G.E. factory built syn. M-G sets 230 KW, 125 V, 600 RPM generator driven by 335 HP, 4600 V syn. motor complete with starting equipment and panels.

1—50 HP Triumph 3-60-440V, type CII, 1150 RPM, slip ring, rotor & stator rewound

1—50 HP General Electric, 3-60-440V, 900 RPM, type I-M, slip ring

1—50 HP General Electric, 3-60-440V, 720 RPM, type IK, Sq. Cage

2—50 HP Allis-Chalmers 3-60-440V, 690 RPM slip ring

1—50 KW, Allis-Chalmers, factory-built, 3 bearing M-G set, 125 volt DC, driven by 75 HP, 3 phase, 60 cycle, 220 volt, 1165 RPM motor

1—50 HP General Electric 3-60-440V, 690 RPM, MTS 46, slip ring

1—50 HP Ideal 3-60-440V, 580 RPM, type AV, slip ring

1—50 HP Wagner 3-60-440V, 485 RPM, type BM, Sq. Cage

1—50 HP Allis-Chalmers, 3-60-440V, 400 RPM, Sq. Cage

1—50 HP General Electric 3-60-440V, 400 RPM, type I-M, slip ring

1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage

1—50 HP Howell, 3 ph, 60 cy, 440V, 1165 RPM, type SC50-4, ball bearing

1—50 HP Allis-Chalmers, 3 ph, 60 cy, 550V, 860 RPM sq. cage

1—50 HP General Electric, type I-M, 3 ph, 60 cy, 440V, 720 RPM slip ring

1—45 KVA Fairbanks Morse, 3 ph, 60 cy, 220V, 1200 RPM alternator

2—30 HP Fairbanks-Morse, 3 ph, 60 cy, 2220V, 3600 RPM, type HO, frame 128 ball bearing

2—drag generators, 15 KW, Westinghouse, SK111, 125 V, 450/1800 RPM gear head, ratio 10 to 1, used a few months.

2—175 HP, 230V, DC Westinghouse, type SK, 150 to 550 RPM

1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM

1—60 HP Westinghouse, type SK140L, 115V, 1150 RPM vertical

1—50 HP Westinghouse SK200, 230V, 250/900 RPM

2—40 HP, G. E., 3 ph, 60 cy, 440V, 435 RPM, type 1-13A

25 CYCLE MOTORS

1—50 HP Westinghouse 3-25 cy-440V, 720 RPM, type MS, Sq. Cage

1—50 HP General Electric, 3-25 cy-440V, 700 RPM, type I-M, slip ring

1—40 HP Westinghouse 3-25 cy-440V, 720 RPM, type CI, frame 753A slip ring crane

1—35 HP Allis-Chalmers 3-25 cy-440V, 720 RPM, slip ring

1—30 HP Westinghouse 3-25 cy-440V, 720 RPM, CS. Sq. Cage

The Wente Electric Co.
Hamilton, Ohio

REBUILT MOTORS & GENERATORS SINCE 1906

REBUILT POWER EQUIPMENT

READY TO SHIP!

MOTOR GENERATOR SETS

1—300 kw. West. 550 v. DC 1200 rpm. 2200 v. 3/60 complete with AC and DC swb; also automatic reclosing circuit breaker.
1—1000 kw. G.E. M.G. Set 2300 v. AC, 250 v. DC, 720 rpm.

SLIPRING MOTORS—3 PH., 60 CY.

H.P.	Make	Volts	R.P.M.	Type
5	G.E.	440	1200	MT
20	Westg.	220	1735	CW
20	Cr. Wh.	220	850	
40 to 50	Westg.	440	1150	CW
50	G.E.	220/440	1160/560	CM-7
50	Westg.	440	1150	CW636A
50	Westg.	440	1145	HF
50	Chandeys'n	220/440	1800	
50	G.E.	220/440	1200	HI
50	Allis Chal.	220	400	
54	Allis Chal.	440	900	
75	West.	220/440/2200	580/290	CW
75	Westg.	220/440	690	CW
100	G.E.	2200	450	I-M
100	West.	2200	490	CW
150/75	West.	220/440/2200	580/290	CW
150	West.	2200	375	CW
150	West.	2300	490	CW
150	West.	220/440	490	CW
150	G.E.	220	375	I-S
185		2300	900	
200	Burke	440	600	EMV-65
300	G.E.	440	900	I
300		2300	720	
400	Westg.	2300	580	CW
400	Westg.	2200	435	CW-1214
600	G.E.	550	150	I
600	G.E.	2200	600	MT-12
1800	Westg.	2200	435	CW

ALTERNATING CURRENT MOTORS 3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
35	West	220/440/550	1200	CS
25	G.E.	220/440	580	KF
30	G.E.	440	1800	KT
30	Line. Elec.	220	600	
30	Duquesne	440	600	
30	Allis Ch.	220	900	
30	Triumph	220	525	TR-138
30	Western	220	900	
30	Allis Chal.	220/440	1200	
35	Lincoln	220	720	
35	Al. Ch.	550	1200	
40	Powell	220	900	SO
40	Line. Elec.	220	900	
40	Westg.	440	900	C
40	Westg.	440	600	C
40	G.E.	220/440	1160	K
40	Duquesne	220/440	850	
40	G.E.	440	1800	L-4
40	G.E.	440	1800	KT-837-4
40	G.E.	440	1800	L-4
50	Fair Morse	220	900	
50/150	West.	2200	360/720	CS-954
50	Westg.	440	1800	C
50	Western El.	220	570	KT-346
50	Chandeys.	220/440	1800	
50	Duquesne	440	1200	
50	Allis Chal.	440	1800	AN
50	West.	440	1120	C
50	G.E.	220/440	1200	HI
50	Westg.	440	690	C
50	Allis Chal.	2200	865	
50/32	G.E.	440	800/640	
60	Westg.	440	1800	C
60	Duquesne	440	1800	
60	G.E.	440	1800	L-4
75	West.	440	1200	CCL
75	West.	220/440 (Linestart)	2550	CS-W4458
75	Louis Allis	220/440	1770	505Y
	Adjusto speed—splash proof—ball bearing			
75	West.	2320/230/440	720	CS
100	Allis Chal.	220	1750	
100	Allis Chal.	220	600	
100	G.E.	440	400	I-K
100	West.	440	1200	CX
100	West.	440	1200	CCL
125	West.	440	1200	CX
125	West.	2300	1170	CS
125	G.E.	440	450	I
125	G.E.	220/550	400	I
150	New Amer.	480	720	SYN
150	West.	440	1200	CX
150	West.	220/440	327	Syn.
150	Wagner	440	1800	31V
150	G.E.	440	514	I
150	G.E.	220/550	450	I
150	G.E.	550	375	I-K
150	G.E.	2200/220/440	450/243	
150	Westg.	2200	327	LC-Syn.
50/150	West.	2200/440/220	360/720	CS
(Complete with Niles Speed Reducer, ratio 10:1)				
175	G.E.	2200	600	I-12
200	Westg.	440	1700	CS
200	Westg.	2200	900	
200	G.E.	220/500	514	I
400	West.	2200/220/440	500	CS
500	G.E.	220/440	1170	KTP-567
1000	G.E.	2300	509	K
1500	G.E.	2200/220/440	225	ATI-Syn.
2000	G.E.	2200/220/440	240	TS-Syn.
3500/4000	West.	4000/23000	900	Syn.

VARIABLE SPEED MOTORS—230 VOLT D.C.

H.P.	Make	R.P.M.	Type
2¼	Westg.	450/900	SK-30
2½	G.E.	500/1000	RLC
2½	Reliance	500/1000	14T
2¾	Westg.	900/1800	SK
3	Jantz-Liest	650/1950	BI-DC
3	Roth (Enclosed)	500/1000	RS
3	West.	850/1700	SK-33
3¼	West.	400/1600	SA
3½	Westg.	850/1700	
3½	Reliance	300/600	
5	Allis Chal.	450/1800	E-90
5	Reliance	300/1800	21
6	Roth	500/1000	RS
7½	Westg.	450/900	80L
7½	Reliance	650/1300	550v.
7½	Westg.	1125/2905	SK-43
7½	West.	400/1600	SA
10	Westg.	565/1130	S-6
10	G.E.	625/1250	LC
10	West.	400/1600	SA
15	Louis Allis	1150/1750	NA
15	Reliance	500/1800	
15	West.	850/1700	SK-90
15	West.	675/1350	SK-100L
20	West.	900/1800	SK-100L
20	G.E.	270/540	
20	Westg.	750/1500	SK-110L
20	Westg.	750/1125	SK
30	G.E.	450/900	RLC
35	G.E.	375/1400	IC
50	G.E.	600/1200	500 v.
75	West.	475/950	SK-180
75	West.	400/650	SK-181
75/150	Reliance	940/1250	

TRANSFORMERS—1 ph. 60 cy.

No.	Kva.	Pri.	Sec.	Make
1	5	550	110	Pgh.
7	5	1100/2200	132/244	G.E.
4	5	1100/2200	122/244	West.
7	5	1040/2080	115/230	G.E.
3	5	2200	120/240	G.E.
20	7½	2200/1100	240/120	West.
60	7½	1100/2200	120/240	G.E.
19	7½	2200	240/120	G.E.
6	7½	2080	120/240	West.
8	10	2200/1100	240/120	West.
6	10	2200	120/240	G.E.
2	10	1100/2200	120/240	G.E.
3	10	2080	115/230	G.E.
2	15	400/30000/50000		Amer.
1	25	1100/2200	120/240	G.E.
6	35	220	110	West.
1	37½	2300	220/110	Wagner
3	50	6600	575/440/220	G.E.
2	50	6600	550	Allis Chal.
6	75	2200/4000	220/110	West.
6	75	440	205	West.
1	75	2300	220	Burke
2	100	6600	220/440/550	Pgh.
4	50	6600	550/440	Pgh.

INDUSTRIAL TRUCKS

1—Baker Tow Truck with batteries.
1—2000 lb. Elwell Parker lift Truck, 7'6" lift, 9'4" overall height, 10' length.
1—4000 lb. Yale Electric Industrial Truck, model K-22A.

CHAIN BLOCKS—with or without trolleys

2—Chisholm Chain Blocks 2 tons
2—Ford Triblock—2 ton
4—Ford Triblock—3 ton
1—Phila.—3 ton

HOISTS

1—3 ton Westinghouse Hoist with Westinghouse DC Motor, 1600 rpm.

INDUCTION MOTOR GENERATOR SETS

250 Volts Compound Wound, D. C.—3 Ph., 60 cy. Motors

KW	Make	RPM	AC volts
2	Crocker Wheeler	1750	220/440
3	Westinghouse	1150	220/440
5	Allis Chalmers	1150	220/440
7½	Allis Chalmers	1150	220/440
10	General Electric	1150	220/440
15	Westinghouse	1150	220/440
20	Westinghouse	1150	220/440
25	Westinghouse	1150	220/440/550
35	G.E.	1150	220/440
35	Westinghouse	850	220/440
40	West.	1150	220/440
75	Reliance	1150	220/440
100	Reliance	1150	220/440

D.C. CLARK CONTROLLER

1—250 HP Clark Vari-time magnetic controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

A.C. GENERATORS

35 KW Crocker Wheeler 240/480 v. 3 ph. 60 cy. 1200 rpm.
62½ KW Westg. 3 ph. 60 cy. 220/440/2300 v. 1200 rpm.
125 KVA New American Electric 480 v. 720 rpm. type OG-56.
125 KVA West., 220/220/440 v., 3 ph., 60 cy., 327 rpm.
150 KVA Wagner, type BF, 600 rpm., 400 v., 3/60
250 KW Al. Ch., 480 v., 150 rpm., 3 ph.
260 KVA West. 220 v., 3 ph., 60 cy., 360 rpm.

SPEED REDUCERS

1—1 HP, D. O. James, size 32, ratio 20:1.
1—1 HP Boston Worm Reduction Unit, ratio 30:1.
2—2½ HP, Link Belt triple reduction, ratio 221:1.
2—3 HP, Link Belt triple reduction, ratio 221:1.
2—3 HP Link Belt Triple Reduction Herringbone, ratio 221 1.
2—4 HP, Link Belt triple reduction, ratio 221:1.
2—5 HP, Link Belt triple reduction, ratio 221:1
1—5 HP, Sturtevant 900 rpm., ratio 14½ to 1.
2—7 HP, Link Belt triple reduction, ratio 221:1.
1—7½ HP, Sturtevant 1200 rpm., ratio 14½:1.
2—15 HP, Link Belt double reduction, ratio 24½:1.
1—20 HP, Sturtevant 3700 rpm., ratio 14½:1.
2—20 HP, Link Belt double reduction, ratio 24½:1.
2—25 HP, Link Belt double reduction, ratio 24½:1.
1—25 HP W. A. Jones 300 rpm. ratio 9.143:1.
2—30 HP, Link Belt double reduction, ratio 24½:1.
2—30 HP, Link Belt single reduction, ratio 4.33:1.
2—35 HP, Link Belt double reduction, ratio 24½:1.
1—36 HP Cleveland Model 150, size 900 AT, ratio 43:1.
1—40 HP W. A. Jones 430 rpm. ratio 9.143:1.
2—40 HP, Link Belt single reduction, ratio 4.33:1.
2—50 HP, Link Belt single reduction, ratio 4.33:1.
2—50 HP W. A. Jones 875 rpm. ratio 9.143:1.
1—50 HP Niles Bement Pond double reduction, ratio 10:1.
2—50/150 HP Niles Bement Pond double reduction, 35 rpm. low speed, 70 rpm. high speed, 360/720 rpm. ratio 10:1.
1—75 HP W. A. Jones 875 rpm. ratio 9.143:1.
2—75 HP Niles Double Reduction 350 rpm. ratio 10:1.
1—100 HP W. A. Jones 1150 rpm. ratio 9.143:1.
2—100 HP Niles double reduction 660 rpm. ratio 10:1.
1—125 HP Niles double reduction 600 rpm. ratio 10:1.
3—150 HP Niles double reduction 720 rpm. ratio 10:1.
1—175 HP Jones 1750 rpm. ratio 9.143:1.
2—180 HP Cleveland size 1000 AT ratio 9-2/5:1.
1—200 HP Falk, ratio 3:1.
2—200 HP Niles Bement Pond double reduction, 360 rpm. ratio 10:1
1—235 HP Nuttal, ratio 1.6:1.
2—300 HP Niles Bement Pond double reduction, 1150 rpm. ratio 10:1.
1—300 HP Nuttal, ratio 1.6:1.
2—400 HP Niles Bement Pond double reduction, 1750 rpm. ratio 10:1.
1—400 HP Nuttal, ratio 1.6:1.

Large Stock—CIRCUIT BREAKERS—METERS — CURRENT AND POTENTIAL TRANSFORMERS—POTHEADS—RELAYS — METERS — SAFETY SWITCHES — DISCONNECT SWITCHES — U-RE-LITES — PULLEYS — REACTORS.

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5000 KW. Turbo Generator units complete, Condensing, 200# and 250# pressure, A.C. 2000 KW. Generator, 3/60/2300 v. 600 RPM.

STEPHEN A. DOUGLASS CO.
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2—Aero Foster Wheeler Size F 5000# Coke per hour each, with 50-H.P. Ty F.T. G.E. Motors 440-volt 60 cycle 95% New $3,750.00 each.

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Protection against scale and dirt for pumps, regulators, turbines, etc., in steam, air, gas or liquid service. Large free area, little flow resistance. Self-cleaning—no need to remove screen or shut down line, just blow down. May be used as condensate drain on steam lines. Supplied with brass screens in iron strainers, monel screens in steel strainers. Highest quality. Following metals and sizes on hand:

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Flanged Ends 150 p.s.i. s.w.p. ¾", 1", 1¼", 2", 2½", 3", 4"
Flanged Ends 300 p.s.i. s.w.p. 1¼", 1½", 4"

CAST STEEL

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Flanged Ends 150 p.s.i. s.w.p. ½", ¾", 1¼" to 5" inclusive
Flanged Ends 300 p.s.i. s.w.p. ¾", 1", 1¼", 1½", 2½", 3½" 5"
Flanged Ends 400 p.s.i. s.w.p. 1", 1½", 2½", 3", 4", 5", 6"
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BOILERS—stacks—Engine Generator

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TURBO UNITS—60 Cy.

1—15300 KVA Westinghouse Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 3125 KVA Westinghouse Cond.
1— 2500 KVA Westinghouse Cond.
1— 1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extrac.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 625 KVA General Electric Non-C.
1— 500 KVA Westinghouse Non.-C.
1— 470 KVA Westinghouse Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.
1— 107 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
1— 375 KVA Nordberg Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 218 KVA Skinner Uniflow
1— 150 KVA Skinner Uniflow
1— 100 KVA Skinner Uniflow
1— 94 KVA Ridgway 4-valve
1— 93.8 KVA Skinner Uniflow

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1—400 KW Ridgeway 4-valve 275 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—250 KW Ames Uniflow 250 V.
1—150 KW Ridgway 4-valve 125/250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire
1—100 KW Elliott 4-valve 250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.

1—625 HP Worthington, 240 V. gen.
1—610 HP Campbell, 2400 V. gen.
1—600 HP West. (gas), 480 V. gen.
1—520 HP Busch Sulzer, 2400 V. gen.
1—375 HP Worthington, 240 V. gen.
1—375 HP Anderson, 2300 V. gen.
1—360 HP Fair.-Morse, 2400 V. gen.
1—300 HP Worthington, 2300 V. gen.
1—283 HP Coop.-Bess., 230 V. gen.
1—175 HP Sterling (gas), 480 V. gen.
3—160 HP Coop.-Bess., 218 V. gen.
1—145 HP Superior, 220 V. gen.

A. C. GENERATORS

2—1500 KVA G. E. 25 cy. 2200 V. 750 RPM
2—1250 KVA G. E. 60 cy. 480 V. 750 RPM
1— 750 KVA G. E. 60 cy. 230-460 V. 300 RPM
1— 680 KVA G. E. 25 cy. 13200-4000 V. 300 RPM
1— 503 KVA G. E. 60 cy. 2300 V. 360 RPM
1— 360 KVA West. 60 cy. 240 V. 360 RPM
1— 94 KVA G. E. 60 cy. 2300 V. 600 RPM
4— 48 KW Elec. Mcy. 60 cy. 2400 V. 1200 RPM

SURFACE CONDENSERS

1—20,000 sq. ft. Worthington
1—12,000 sq. ft. Worthington
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1— 4,100 sq. ft. Ross

WATER TUBE BOILERS

1—850 HP B. & W. 250-lb., Stoker
1—750 HP Edge Moor 200-lb.
2—612 HP Stirling 200-lb., Stoker
1—600 HP Union 250-lb., Stoker
2—560 HP Erie City 460-lb.
2—512 HP Stirling 205-lb.
1—335 HP B. & W. 200-lb.
2—300 HP Heine 200-lb.
2—300 H.P B. & W. 160-lb.
4—200 HP B. & W. 200-lb., Hand Fired

SYNCHRONOUS MOTORS

2—1250 HP G. E. 25 cy. 2200 V. 750 RPM
2—1125 HP G. E. 60 cy. 480 V. 720 RPM
1— 850 HP G. E. 25 cy. 13200-4000 V. 300 RPM
1— 800 HP G. E. 60 cy. 440 V. 120 RPM
1— 770 HP G. E. 60 cy. 230-460 V. 300 RPM
1— 620 HP G. E. 60 cy. 440 V. 164 RPM
1— 150 HP West. 60 cy. 2200 V. 600 RPM
1— 100 HP G. E. 60 cy. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.

4—3500 HP G. E. slip ring 2300 V. 120 RPM
1—1000 HP G. E. sq. cage 2300 V. 509 RPM
1— 600 HP G. E. sq. cage 440 V. 900 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
2— 300 HP G. E. sq. cage 440 V. 600 RPM
2— 250 HP G. E. sq. cage 2300/4000 V. 1200 RPM

MOTOR GEN. SETS—60 Cy.

1—1500 KW Allis Chalmers 600 V. DC
1—1000 KW General Electric 600 V. DC
1—1000 KW Westinghouse 250 V. DC
1— 75 KW General Electric 125 V. DC
1— 75 KW Westinghouse 250 V. DC

ROTARIES—60 Cy.

2—2600 KW General Electric 250 V.
2—2500 KW Westinghouse 250 V.
2—1700 KW General Electric 250 V.
1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
2— 750 KW General Electric 600 V.
1— 750 KW Westinghouse 225/275 V.
1— 500 KW General Electric 250 V.
1— 500 KW General Electric 600 V.

SYN. CONDENSERS—60 Cy.

1—5000 KVA West. 5000 V. 720 RPM
2—1250 KVA G. E. 480 V. 720 RPM
1— 750 KVA G. E. 230-460 V. 300 RPM
1— 500 KVA West. 2200 V. 900 RPM

FREQUENCY CHANGERS

2—12500 KW G. E. 60/25 cy. 300 RPM
2— 5000 KVA West. 25/60 cy. 300 RPM
2— 3125 KVA West. 25/62½ cy. 750 RPM
1— 2500 KVA West. 25/60 cy. 300 RPM
1— 1875 KVA G. E. 25/60 cy. 300 RPM
2— 1250 KVA G. E. 25/62½ cy. 750 RPM
1— 1250 KVA G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 60/25 cy. 300 RPM

TRANSFORMERS— 1 Ph. 60 Cy.

1—10000 KVA West. 120,000/66000-13200 V. 3 ph.
3— 2500 KVA Pitts. 66000-25400/12700 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 1250 KVA G. E. 66000-13200 V.
3— 750 KVA Pitts. 66000/33000 V.
3— 200 KVA G. E. 66000-13200/22800 V.
3— 200 KVA G. E. 33000-2300/4000 Y V.
3— 75 KVA G. E. 33000-13200/11000 V.
1—15000 KVA Al. Ch. 27880-4560 V. 3 ph.
2—10000 KVA West. 26400-4580 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
3— 833 KVA G. E. 22000-2300/4000 Y V.
3— 667 KVA Packard 23000-440 V.
3— 250 KVA G. E. 22000-11000 V.
1— 6000 KVA West. 13200-2300 V. 3 ph.
6— 1667 KVA Pitts. 13200-2300 V.
3— 1000 KVA G. E. 13200-2300 V.
3— 200 KVA G. E. 13200-2300 V.
3— 200 KVA G. E. 13200-480 V. Pyranol
7— 667 KVA Moloney 11000-2300 V.
3— 150 KVA Pitts 11000-2400 V.
3— 100 KVA West. 11000-250/125 V.
3—1250 KVA G. E. 6600-550 V.
3— 150 KVA Al. Ch. 2400/4800 V.

VOLTAGE REGULATORS

60 Cycle Induction

6—96 KVA 400 A. 2400 V. Gen. Elec.
1—72 KVA 300 A. 2400 V. Gen. Elec.
2—48 KVA 200 A. 2300 V. West.
6—36 KVA 150 A. 2400 V. Gen. Elec.
6—24 KVA 100 A. 2400 V. Gen. Elec.

OIL CIRCUIT BREAKERS

1— 400 A. 73 KV G. E. FHK036 Outdoor
1— 400 A. 73 KV G. E. FHK036 Outdoor
1— 800 A. 37 KV G. E. FHK0136 Outdoor
6— 400 A. 37 KV G. E. FHK0136 Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kalman CB76 Outdoor
4— 600 A. 15 KV G. E. FK060B Outdoor
2— 400 A. 15 KV G. E. FHK0136 Outdoor
2— 600 A. 25 KV West. B-13 Indoor
1—2000 A. 15 KV West. E6 Indoor
1—1500 A. 15 KV West. E6 Indoor
2—1500 A. 15 KV G. E. FK12 Indoor
3— 600 A. 15 KV G. E. FK32G Indoor
6—1200 A. 4.5 KV Condit D-12 Indoor
2—1000 A. 4.5 KV Condit D-12 Indoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 CHURCH STREET, NEW YORK CITY 7, NEW YORK

PARTIAL LIST OF OUR COMPLETE STOCK FOR IMMEDIATE SHIPMENT

PUMPS

G.P.M.	Head	Make	Type
9700	110'	Ing. Rand	Centrif.
6000	35'	LeCourtenay	Centrif.
3800	140'	Kingsford	Centrif
3800	150'	Goulds	Centrif.
1100	220'	Allis-Chalm.	Centrif.
1000	147'	Allis-Chalm.	Centrif.
1800	180'	Penna.	Centrif.
400	635'	LeCourtenay	Centrif.
250	535'	LeCourtenay	Centrif.
400	350'	Goulds	Triplex
300	500'	Goulds	Triplex
175	500'	Goulds	Triplex
800	175'	Blackmer	Rotary
450	221'	Kinney	Rotary
300	150'	Viking	Rotary
300	175'	Blackmer	Rotary
1000	460'	Knowles	Steam
800	460'	Knowles	Steam
2000	50'	Lawrence	Sump
300	231'	Gardner	Plunger

M.G. SETS BOILER FEED PUMPS

K.W.	Make	Volts	Type
35	Green Eng.	220	Belt Drive
100	Ames	240	dir. dr. Eng.
5	Ames	240/120	dir. dr. Eng.
77	Sturt. Turb	110	Direct Drive
½	Sturt. Turb	110	Direct Drive

MOTORS (D. C.)

100	Northwest	230	1750
25	Imperial	220	450

STORAGE TANKS

5 to 1000 Gal. Steel Press.
15 to 300 Gal. Conden. Tanks

CONDENSATION RETURN UNITS

Nash-Jenn Dup. Vac. Heat. 24000EDR
Nash-Jenn Sump Vac. Heat. 16000EDR
Condensation Units 100 to 250,000EDR

AIR COMPRESSORS

C.F.M.	Pressure	Make	Type
850	100	Laidlaw	Hor. Dup.
500	60	Ind. Rand	Steam
400	125	American	Horiz.
350	40	Worthing	Horiz.
250	100	Sullivan	Horiz.
220	100	Gardner	Gas Eng.
173	100	Ing. Rand	Horiz.
28	5000	Norwalk	4-Stage

TURBO-CENTRIFUGAL BLOWERS

3000	16 lbs.	In Rand	Motor dr.
3000	8 lbs.	In Rand	Motor dr.
950	24 oz.	Spencer	Motor dr.
900	5½ lbs.	In. Rand	Motor dr.
700	2½ lbs.	Allen Billmyer	Motor dr.
675	24 oz.	Spencer	Motor dr.
250	16 oz.	Spencer	Motor dr.

BLOWERS

C.F.M.	St. Pres.	Make	Type
100–60000	¼"–5'	Buffalo	Various
100–15000	¼"–16 oz.	American	Various

ROTARY PRESSURE BLOWERS

C.F.M.	Press	Make	Type
10000	2 lbs.	Roots	Belt dr.
6000	3 lbs.	Roots	Belt dr.
3000	3 lbs.	Roots	Belt dr.
2000	3 lbs.	Sturt.	Belt dr.
1000	3 lbs.	Roots	Belt dr.
200	5 lbs.	Baker	Dir. dr.
110	15 lbs.	Beach R.	Belt dr.

VACUUM PUMPS

1000	15 in.	Roots	Belt dr.
350	27 in.	Worth.	Belt dr.
100	high vac	Beach R.	Gear dr.
100	27 in.	Deane	Belt dr.
300	29 in.	Devine	Belt dr.

MOTORS (3 ph. 60 cy.)

H.P.	Make	Volts	Speed	Type
300	G.E.	2300/4000	1800	Sya.
150	West.	440	700	CB
125	G.E.	220	1150	Vertical
100	Lincoln	220	1750	
60	West.	220	1750	CB
50	G.E.	2300	1750	I
50	West.	220	850	CCL
50	West.	220	570	CB
40	G.E.	220	870	342
30	G.E.	220	1750	312
30	Wagner	220	850	sl. rg.
30	Wagner	220	1150	

STEAM ENGINES

Turb. Cent. Bronze Pumps
Steam Pumps — All Sizes
10"x10" Greenfield Vertical
7"x7" Wickes Bros. Vertical
6"x6" Vertical & Smaller
1 to 40 H.P. Steam Turbines

SIMILAR EQUIPMENT IN STANDARD MAKES AND SMALLER SIZES
HIGHEST PRICES PAID FOR YOUR IDLE EQUIPMENT

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Wagner "Certified Rebuilt" Electrical Apparatus

QUICK SHIPMENT—Partial Listings—Send for Complete Catalog!

SQUIRREL CAGE MOTORS

3 Phase—60 Cycle—220 or 440 Volts

Qua.	HP	Mfr.	Type	Speed
1	250	G.E.	I-K	900
1	150	Gen. Elec.	I-K	1200
1	150	Cr. Wheeler	126Q	600
1	150	Gen. Elec. 2200 v.	I-K	1800
1	125	Whse. b.b. 2200 v.	C8771C	1800
1	100	Allis Ch.	AN	1800
1	100	Allis Ch.	AN	900
1	100	Allis Ch.	AN	600
3	75	Allis Ch.	AN	720
1	75	Whse.	CCL	720
1	75	Gen. Elec.	I-K	600
1	60	Gen. Elec.	I-K	514
2	50	Westinghouse	CS	1200
2	50	Allis Ch.	AN	900
1	50	Allis Ch.	AN	514
2	50	Gen. Elec.	KT336	1200
1	40	Whse.	CX	600
1	40	Gen. Elec.	I-K	1200
3	40	Fair Morse b.b.	H12C	900
3	40	Allis Ch.	AR420	900
1	40	Gen. Elec.	KT342	720
6	30	Allis Ch.	AN	1200
1	30	Allis Ch. b.b.	AR220	900
2	30	Allis Ch.	AN	600
2	30	Gen. Elec.	KT326	720
2	30	Whse.	C8567C	1200
1	30	Gen. Elec.	K505	600
3	25	Allis Ch.	AN	1200
4	25	Allis Ch.	AN	900
1	25	Fair Morse b.b.	H10C	3600
2	25	Allis Ch.	AN	600

SLIP RING MOTORS

3 Phase—60 Cycle—220 or 440 Volts

Qua.	H.P.	Mfr.	Type	Speed
1	400	G.E. 2200 v.	I-P	1200
1	300	G.E. 3 brg.	I-P	450
1	300	Burke	EMVi	225
1	200	Whse.	CW	600
1	200	Cr. Wh. 3 brg.	8R26Q	720
2	150	Triumph	SR	514
1	100	G.E. 2200 v.	I-E13A	1800
1	100	Gen. Elec. 3 brg.	I-M	450
1	75	Gen. Elec.	MT356	900
1	75	G.E. 2200 v.	I-E13	1800

SLIP RING MOTORS—Cont.

1	75	Allis Ch.	ANY	600
1	75	Gen. Elec.	MT558	600
1	75	Whse. b.b.	CW662D	1200
1	65	P & H b.b. int.	CA16	900
2	60	Whse. 2200 v.	CW657	1800
5	60	Gen. Elec.	M-505	1200
1	50	Gen. Elec.	MT536	1200
1	50	Al. Ch. bb. 2200 v.	ARY	900
1	50	Allis Ch.	ANY	720
1	50	Gen. Elec.	MT342	900
1	40	Northw'n	HW35A	1200
6	40	Gen. Elec.	MT532	1200
2	40	G.E. 2200 v.	MT332	1200
1	40	Howell	SR	3600
1	40	Gen. Elec.	MT546	514
1	40	Fair. Morse b.b.	HV-M12C	900
1	35	Fair Morse b.b.	HV-12B	1800
2	30	Northw'n b.b.	HW404	1800
2	30	Allis Ch.	ANY	900
1	25	Gen. Elec.	MT322	1200
2	25	Allis Ch.	ANY	900
1	20	Whse.	CW	1200
1	20	Wagner	19TRS	900
1	20	Gen. Elec.	I-M	600

SYNCHRONOUS MOTORS

H.P.	Mfr.	Type	Volts	Speed
300	Whse.	ped.	220/440	900
250	G. E. 1 brg.	ATI	220/440	600
165	G.E. 3 brg.	TRB	220/440	450
100	Allis Ch.	SPF	220/440	600

60 CYCLE A. C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
300	Whse.	ped.	240/480	900
250	Gen. Elec.	ATB	240/480	600
125	Whse.	ped.	2300	600
100	Cr. Wheeler		240/480	600
100	Gen. Elec.	ATB	240/480	900
40	Burke		240/480	1200

ALSO IN STOCK . . . 25 CYCLE & 2 PHASE MOTORS . . . OIL SWITCHES . . . PUMPS . . . BLOWERS & FANS . . . SPEED REDUCERS

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
100	Gen. Elec.	DLC	250	700
75	Whse.	SK	250	800
55	Bullock	ped.	250	900
50	Gen. Elec.	CL	125	875
50	West. Elec.	E	230	850
25	Gen. Elec.	DLC	125	900
20	Gen. Elec.	RC	230	1150
16	Cr. Wheeler	CCD	125	415

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
100	Gen. Elec.	DLC	230	875
75	Whse.	SK	230	600
75	Whse.	S13L	230	450
50	National	CS	230	800
30	Bogue	Interpole	230	700
30	Reliance b.b.	185T	230	800/1600
25	Gen. Elec.	RC10	500	1800
25	Gen. Elec.	LC	230	1700
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
20	Gen. Elec.	DLC	230	500/1500
20	Fair. Morse	TR	230	825/1800
20	Whse.	SK	230	850

M-G SETS

250 KW Burke comp. interpole gen. DC 125V, coupled to 375 HP Burke synch. motor 3-60-220/440 V.—900 RPM.

100 KW Gen. Elec. 3 brg. unit, type RC gen. DC 125V. coupled to 150 HP I-M sq. cage motor 3-60-2300/4000 V.—1200 RPM.

CENTRIFUGAL PUMPS

14" Foster Wheeler, 5000 gpm @ 45 ft.
10" Weinman, 2500 gpm @ 40 ft.
8" Alberger, 2000 gpm @ 80 ft.
6" Platt, 1000 gpm @ 230 ft.

ARTHUR WAGNER COMPANY

1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409

SWITCHES

1—3000 amp 3 pole 600 volt type FK25 General Electric

2—400 amp 3 pole outdoor type FHKO136 General Electric

1—800 amp 3 pole type B20 outdoor with house

10—1200 amp 3 pole FK32B General Electric

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries. What have you for sale?

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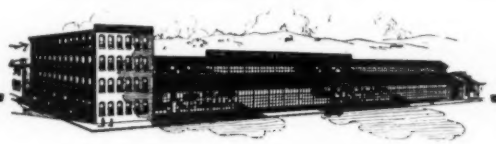

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ENGINE-GENERATOR UNITS

We will pay cash for like surplus equipment.

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A C TURBINE UNITS

6250 KVA G.E., 2300 V., cond.
3750 KVA G.E., 2300 V. cond.
3125 KVA G.E., 4100/2300 V. cond.
3125 KVA GE 480 V, BLEEDER.
2500 KVA G.E., 2300 V. cond.
2500 KVA Al. Chal. 440 V. cond.
1875 KVA G.E., 2300 V. Cond.
1250 KVA (2) G.E., 2300 V. cond.
940 KVA Wghse. 6600 V. cond.
937 KVA G.E., auto BLEEDER, 2300 V.
937 KVA G.E., 2300 V. cond.
937 KVA Al. Chal. 2300 V. 300#.
780 KVA Al. Chal. 2300 V. cond.
750 KVA G.E., 2300 V. cond.
625 KVA Wghse. 2300 V. cond.
375 KVA G.E., 2300 V. cond.
312 KVA Elliott 480 v. cond.
250 KVA Al. Chal. 480 V. BLEEDER.
150 KVA Wghse. 240 V. cond.

(NON COND.)

500 KVA Wghse 480/240 V.
375 KVA G.E., 2300 V.
312 KVA C.W.—Moore, 450#, 240 V.
125 KVA G.E., 480/240 V.
75 KVA Al. Chal. 240 V.

BOILERS

850 HP B&W W. T. Boiler 250# with Riley Stoker.
749 HP (2) Edgemoor, 200#
728 HP Erie City, Ver. 200#
612 HP Sterling 250# Chain Gr. Stoker.
522 HP Kidwell 207#, 3 drum.
471 HP Erie City Ver., 160#
396 HP B. & W., 160#
300 HP (2) Union Iron Wks. Cross drum 175#.
287 HP (2) B&W 160#
259 HP (3) Wicks ver.; 160# pulverizers.
255 HP Casey Hedges 160#.
153 HP (2) Union I-Wks 160# (stokers)
Two 78" x 18' HRT 125# pulverizers.

DIESEL ENGINE SETS

375 KVA Wghse.—Busch Sulzer
312 KVA G.E.—Anderson
312 KVA G.E.—McIntosh Sey.
200 KVA G.E.—Busch Sulzer
125 KVA Ideal-Primm
105 KVA Ideal-Primm
100 KVA C.W. Bessemer
90 KVA (4) F.M.—F.M. "VA"
75 KVA Al. Chal.—International

DIESEL ENGINES

240 HP Fairbanks 35-E 6 cyl.
225 HP Chicago pneumatic 6 cyl.
80 HP (3) Fairbanks Style V. A.

SPECIAL

750 KVA G.E. 3-60-2300 V. turbo unit; surface condenser.
612 HP Sterling 250#; Cox Chain grate stoker.
522 Kidwell 207# with Fire-rite stoker.

STEAM ENGINE SETS (A C)

675 KVA Burke—24 x 36 Nordberg Unif.
375 KVA G.E.—22 x 27 Erie Ball, 4 V.
325 KVA A.C.—21 x 22 Skinner-Unif.
210 KVA G.E.—19 x 20 Skinner Unif.
150 KVA G.E.—16 x 15 Skinner Unif.
150 KVA G.E.—16 x 16 Skinner S.V.
100 KVA G.E.—14 x 15 Skinner Unif.
60 KVA G.E.—11x13 Skinner unif.

PUMPS (MOTOR DRIVEN)

8000 GPM Al. Chal. 132' head.
7500 GPM 80' head
5500 GPM Buffalo 50' head.
3600 GPM 85' head
3250 GPM 425' head
3000 GPM 100' head
3000 GPM (2) 65' head
1390 GPM 231' head
1200 GPM Al. Chal. 65' head.
1000 GPM Morris 255' head.
725 GPM Wheeler 30' head.
350 GPM 720' head

STEAM ENGINE SETS (D C)

450 KW C. W. 250 V.—Nordberg Unif.
400 KW G.E.-Ridgway 4 V.
300 KW G.E.—Skinner Unif.
150 KW G.E.—Erie Ball 4 V.
100 KW G.E.—Erie Ball 4 V.

AIR COMPRESSORS

2200 CFM Nordberg 100#, Steam and Motor Driven
1080 CFM Nordberg 85#—Motor
500 CFM Ingersoll 100#—Motor
"Steam and Gas Driven"; all sizes

TRANSFORMERS

687 KVA (2) Maloney 13800-460 V.
500 KVA (2) G.E. 6600-2300 V.
500 KVA (2) G.E. 11900/6900-230/460
333 KVA (3) G.E., 13800—320/460
250 KVA (2) G.E. 6600-2300 V.
150 KVA (5) G.E. 2300-120/240
100 KVA (3) G.E. 13200-2300
100 KVA (3) Al. Chal. 22000-440 V.
100 KVA (2) G.E. 13200/6600-440/600 V. & small sizes.

GAS ENGINE UNIT

1000 KVA G.E. 3-60 2300 v.—1200 HP. Rathburn Jones Gas Engine.

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

Rebuilt Motors

3 PHASE, 60 Cycle, 220/440 Volts

HP	Make	Type	RPM
400	General Electric	I-K	900
400	General Electric	I-K	900
350	General Electric	I-K	900
250	General Electric	I-K	900
200	General Electric	KT357	1800
200	General Electric	KT357	1800
200	General Electric	KT357	1800
200	General Electric	KT357	1800
200	General Electric	I-K	900
200	General Electric	I-K	720
150	General Electric	KT357	1200
150	Westinghouse	CCL	900
125	General Electric	KT347	1800
100	General Electric	KT347	1200
100	General Electric	KT347	1200
100	General Electric	KT353	1200
75	General Electric	KT543	1800
75	General Electric	KT343	1800
60	General Electric	KT343	1200
60	Burke	EM7	870
60	General Electric	KT346	900
60	General Electric	KT346	900
50	Westinghouse	CS	1800
50	Westinghouse	CS	1800
50	Westinghouse	CS	1800
50	General Electric	KT327	1800
50	Westinghouse	CS-646A	870
50	Reliance	IJ	1800
40	Westinghouse	CS	1800
40	Westinghouse	CS	1800
40	General Electric	KT323	1800
40	General Electric	KT323	1800
40	General Electric	KT523	1800
40	Burke	EM45	1200
35	Lincoln	D-411	1800
30	Westinghouse	CCL	720
30	General Electric	KT332	1160
*30	Armor	A	850
25	General Electric	I	1150
**25	Westinghouse	CS-444	870
*20	Armor	ET-416	850
*20	Fairbanks Morse	H	900
*20	General Electric	KG-405	880
20	General Electric	KG-404	1150
20	General Electric	KT312	720
20	Fairbanks Morse	H-12A	850
15	Westinghouse	CS371C	1800
15	Westinghouse	CS371C	1800
15	Crocker Wheeler	1100	560
15	Crocker Wheeler	114Q	1800
10	Star	AX	3500
10	Century	SC	685
10	General Electric	K-404	700
10	General Electric	KT312	900
10	Lincoln		1200
7½	Fairbanks Morse	B	1200
7½	General Electric	KT	1200
7½	Wagner	14VBP	1800
5	Westinghouse	CCL	3400
3	U. S.	FRB	1800
3	Fairbanks Morse		900
*1	Master	PA	3425
1	Allis Chalmers	AR	1800

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write for our

NEW LIST

from plants just purchased

Mine Slope Hoist

1—Connellsville Mfg. and Mine Supply Hoist storage capacity for 11,000 feet 1" Rope—Speed 900' per minute.
Motor 500 HP Gen. Elec. Mt. Silpring 3/60/2200/450 RPM. Complete with remote control. Herringbone reduction gears and demountable base and drum.

Write Wire Phone

SLIPRING MOTORS

60 Cycle—3 Phase—220/440 Volts

HP	Make	Type	RPM
500	Westinghouse	CW	575
400	General Electric	I-M	900
250	General Electric	I-M	900
250	Allis Chalmers		505
200	General Electric	I-M	900
75	General Electric	MT-546	900
50	Westinghouse	CW	700
40	Westinghouse	CW-748	690
40	Westinghouse	CW-748A	690
40	Wagner	22WB	540
40	Westinghouse	CW-748	690
40	Westinghouse	CW-748	690
40	Westinghouse	CW-748	690
30	Westinghouse	HF	1745
*20	Westinghouse	CW-644C	575
20	General Electric	MT-332	545
15	General Electric	I-M	900
15	General Electric	MT-322	855
13	Sachsenwerk	D7318	850
11	General Electric	ITC-5008	820
10	General Electric	MT-303Y	1800

* Ball bearing. ** Sealed sleeve bearing.

MOTORS

25 cycle—3 phase—2200 volts

100 H.P., General Electric, type KT588, 750 rpm, serial number 5227257, ball bearing.
100 H.P., Allis Chalmers, type AR, ball bearing, 1500 rpm, serial number 4220GK428N-1-1.
150 H.P., General Electric, ball bearing, type KT557Y, 1500 rpm, serial number 5268756.

MOTOR GENERATOR SETS

1—125 KW Ridgeway 250 V. DC. 1200 RPM Motor 3/440/60/1200 Complete.
1—100 KW Westinghouse Synchronous-Generator 250-275 V. DC—Motor 3/60/2300/900 RPM complete with panels.

FREQUENCY CHANGER SET

1—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM direct connected to Generator 362½/440 V. Complete with exciters and panels.

200 KW., 25 CYCLE, M. G. SET

200 KW. Gen. Elect. Generator, 240 V. DC. 750 RPM. Type MPC. on Factory Base direct connected to 300 HP. Gen. Elect. Type I Form K. 3/25/440 V. 750 RPM. Complete with Motor Starting Equipment and DC. Panels.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

SLIP RING MOTORS

3-HP., 60-CY

HP	Volts	Make	Speed
900	2300	G.E.	900
400	2300	Whse	514
450	2300	G.E.	600
400	2300	Whse.	1200
250	220–440	G.E.	1800
300	2300	G.E.	1800
300	2300	Whse.	514
250	2300	G.E.	600
250	440–550	G.E.	600
200	2200–550	G.E.	1500
200	2200–400	G.E.	600
150	440–220	G.E.	1800
150	440	G.E.	1800
150	550–2300	G.E.	1800
150	550	G.E.	720
125	440–220	G.E.	600
100	550–2200	G.E.	720
100	440–220	G.E.	1800
100	220–440	G.E.	720
100	220–410	G.E.	900
75	220–440	G.E.	900

SYNCHRONOUS MOTORS

3-PH., 60-CY.

600	2300	Whse.	900
350	440–220	G.E.	900
300	440–220	Al. Ch.	600
200	2300–4000	G.E.	1200
110	440	Whse.	900
100	2300–550	Al. Chal.	1800
75	440–220	G.E.	750

PUMP

1—8" Dredge Pump 1880 GPM, 120' Morris Machine Works with direct connected Slip Ring Motor 125 HP, 600 RPM, G.E.

OUTDOOR OIL CIRCUIT BREAKER

1—New 400 Amp. Type FK, 136-1328A, General Elec. 3PST, 25,000 Volt Oil Switch, interrupting Capacity 125,000 KVA, complete CT's PT's, etc.

1—3000 ampere, type FK 25, General Electric, 3 pst, 600 volt

TRANSFORMERS

60 CYCLE

2—500 kva., G.E., type H, form KS, 13800-230/460
3—500 kva., Whse., 22000-2300.
3—350 kva., G.E., type H-KD 13200-4600.
3—333 kva., G.E., type H-KDD 2400-460/230
3—250 kva., Whse., 13,800-460.
3—200 kva., G.E., type H 10000-600.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva., G.E., 4000-480.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Chal., type OISC 10400-2400.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
2—100 kva., Whse., 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse., type SK, 12800-240/120.
3— 50 kva., Whse., 22,000-2300.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
550	440/220	G.E.	IK	900
400	440	G.E.	KTF	1200
400	2200	Whse.	C.S.	1800
300	2200	G.E.	IE-K	1800
250	2200	G.E.	IK	600
250	2200	Whse.	CS	1200
250	440/220	G.E.	IK	1800
200	220/440	G.E.	IK	720
150	2200	Allis Ch.	AN	450
150	440/220	Whse.	CS	514
125	440/220	G.E.	KT	1800
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
60	550	G.E.	FT	3600
50	220/400	G.E.	K	1800

MOTOR GENERATOR SETS

2—150 kw, 125 v., 1200 rpm, Whse., conn. to 220 hp, 440/220 v., 3 ph., 60 cy., syn. very modern, practically new.
75 KW, 125 V. 1200 RPM Westinghouse Conn. to 112 H.P. 2300/440 V. 3 ph. 60 cy. Ind. motor.
1—75 KW 250 V. 1800 RPM, Cr. Wh., Type CCD con. to 100 H.P., 2300 V., 3 ph., 60 cy. syn.

A.C. GENERATORS

1—600 kva., 900 r.p.m., 2300 V. Whse. Condenser.
1—800 kva., 900 r.p.m., 240/480 V., G.E.
1—325 kva., 600 r.p.m., 2200-240 V., G.E.
1—110 kva., 900 r.p.m., 440 V., G.E.
1— 60 kva., 720 r.p.m., 240/480 V., G.E.
1— 25 kva., 3600 r.p.m., 220 V., G.E.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

FOR SALE BY OWNER

Power Plant Equipment

BOILERS and STOKERS

4—500 H.P. 1—440 H.P. 1—524 H.P. Cross drum type B & W Boilers 200# Pressure.
1—183 H.P. 150# Bigelow Boiler.

74 Steam motor & turbine driven pumps for all purposes. Duplex & single acting—large number of motor driven pumps of various pressures up to 6200 G.P.M.

TURBO GENERATORS

1—500 KW G.E. 200# pressure 3 phase 60—2400/480/240 volts condensing. Exciter on shaft 15.6 KW per hour water rate-operating panels and pumps etc. 4 years use—high serial numbers. Other units up to 12500 KW. 1—2500—2—2000—1—1250 KW. 1—50 KW.

Transformers up to 5000 Kva.—3—2500 Kva.—9—300 Kva., 3—500 Kva. Number of smaller sizes.

Assortment of G.E. Flow Meters complete with boards, instruments.

Also have in stock oil circuit breakers up to 3,000 amps. and 74,000 volts—disconnect switches up to 6000 amps.

Stock of 5,000 current and potential transformers of all sizes, all kinds of relays, overload, underload, etc.

We also buy complete plants outright. What have you for sale?

HOWE BROTHERS

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Telephone Nos. Worth 2-2708—2709—2710

Reconditioned Motors, Generators, Control Equipment, etc.
Send for 32 page stock list.
Electric Apparatus Repair Company
Specialists on Rebuilding Motors, Generators and Controls.
1410 No. 6th St., PHILA., PA.

POWER PLANT EQUIPMENT

Turbo-Generators

1—4000 KW GE Cond. 2300 V.
1—3000 KW GE Cont. 600 V.
1—1250 KW West Cond. 440 V.
1— 750 KW West Cond. 6600 V.
1— 600 KW GE Cond. 600 V.
1— 500 KW GE Cond. 600 V.
1— 500 KW GE Cond. 125 V. DC.
1— 400 KW West Non-Cond. 480 V.
1— 200 KW GE Cond. 2300 V.
1— 100 KW GE Cond. 600 V.
1— 75 KW GE N.C. 125 V. DC.

Turbines Only

1—210 HP Terry 250#
1—175 HP GE 110#
1—225 HP Terry with gears

Boilers

1—750 HP Heine 200# Stoker
3—318 HP Manning Type 170#
1—300 HP Heine 250# Stoker
1—150 HP HRT 150# Grates

Air Compressors

1—1214 CFM 100# Motor Driven
1— 600 CFM 500# Steam Driven
1— 368 CFM 100# Belted
1— 386 CFM I.R. Steam Driven

Centrifugal Compressors

10000 CFM 22# Turbine Driven

Pumps

2— 300 GPM 65' Hd. Motor Driven
1—1500 GPM Fire Pump Steam
1—1000 GPM Fire Pump Steam

Engine—Generators

1— 600 KW GE 2300 V.

Miscellaneous

1—4100 Sq. Ft. 2 Pass Surface Condenser
3—Sets of 78" Perfection Stokers for 84" HRT Boilers. New 1943

Also transformers, engines and cranes
Send us your Inquiries

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

COMPLETE POWER PLANTS

STEAM—ELECTRIC—HYDRO—DIESEL

SPECIAL OFFERINGS

4—1000 HP Heine 225# Boilers
3— 750 H.P. Edge Moor 200# Boilers
3— 600 H.P. Edge Moor 200# Stokers
2—570 H.P. B. & W. Sectional 200#, with Stokers
1— 600 H.P. B. & W. Stirling 200#, with Stoker
5—590 H.P. B. & W. 200# with Stokers
6— 440 H.P. B. & W. Sectional 200#, Oil fired
1— 335 H.P. B. & W. Sectional 200 Boiler
Smaller Boilers and Fire Tube Boilers also

1—5000 KW., G.E. Co., Turbo-Generator Condensing
1—5000 KW., W. E. & M. Co., Turbo-Generator Con.
1—3200 KW., Allis-Chal., Turbo-Generator Con.
2—2500 KW., G.E. Co., Turbo-Generator Condensing
2—2000 KW., G.E. Co., Turbo-Generator Condensing
1—2000 KW., W. E. & M. Co., Turbo-Generator Con.
3—1000 K.W., G.E. Co., Turbo-Generator Condensing
2— 750 KW., G.E. Co., Turbo-Generator Condensing
Several 500 KWs. & Smaller. And Non-cond. Units.

CHARLES B. REARICK 30 CHURCH ST., NEW YORK

CHICAGO'S LARGEST STOCK GUARANTEED EQUIPMENT

MOTOR GENERATOR SETS

KW	Make	DC	Volts	AC Volts
1500	Wtg.	250	Syn.	3/60/2300
1200	G.E.	280	Syn.	3/60/4100
1000	G.E.	250	Syn.	3/60/4150
1000	G.E.	600	Syn.	3/60/2300
1000	Wtg.	275	Ind.	3/60/4100
750	Wtg.	275	Syn.	3/60/440
235	Wtg.	125	Syn.	3/60/2200
225	Ideal	125	Syn.	3/60/2200
200	Elliott	125	Ind.	3/60/2200
150	Al. Ch.	250	Syn.	3/60/2300
100	Al. Ch.	125	Syn.	3/60/440
100	Wtg.	250	Ind.	3/60/440
100	Wtg.	250	Ind.	3/60/2200
100	G.E.	250	Ind.	3/60/2200
75	G.E.	250	Ind.	3/60/440
75	G.E.	125	Syn.	3/60/220
60	Al. Ch	110	Ind.	3/60/2200
50	G.E.	250	Ind.	3/60/440
25	G.E.	230	Ind.	3/60/220
22½	G.E.	125	Ind.	3/60/220
15	Ideal	220	Ind.	3/60/220
10	G.E. 115/230			Balancer set
7½	G.E.	60	Ind.	3/60/440
7½	Jen. 115/230			Balancer set
5	Roth 125/250			Balancer set
3½	G.E.	230	Ind	3/60/220
3	Lincoln	115	Ind.	1/60/220
3	Lincoln	115	Ind.	1/60/220
3	Westg.	25	Ind.	3/60/220
2½	Acme	45	Ind.	3/60/220
2¼	Wotton		Ind.	1/60/110/220
2.4	Lincoln	80	Ind.	3/60/220
3 HP	Roth	110	2 KVA	1/60/110
2	El Sp.	750	Ind.	3/60/440
1	Holts. C	65		220 D.C.
.5	Rob. M.	115		Variable voltage
.378	G.E.	110	Ind.	1/60/110
.250	Robbins	125	Ind.	1/60/125
.250	Roch.	120	Ind.	1/60/110/220
.2	G.E.	6		115 v. d.c.
.2	G.E.	6	Ind.	1/60/110/220

FREQUENCY CHANGERS

1400 HP General Electric type ATI-24-1250M-300, form C, 3 ph., 60 cy., 460 volt, 300 RPM, 1570 amps., 1250 KVA, 0.9 P.F. 50° synchronous motor with amort. wdg.; dir./conn. to 1000 KW General Electric type ATI-10-1250M-300, 3 ph., 25 cy., 460 volts, 300 RPM, 1570 amps., 1250 KVA, 0.8 P.F. 50° A.C. generator with amort. wdg., with 33 KW G.E. 125 volt direct connected exciter. (This is a three brg. unit suitable for operation from either end.)

40 KW Howell, SR-5454, 3 phase, 60 cycle, 440 volt to 40 HP 3 phase, 25 cycle, 40 volt, SC-443, .8 p.f., 750 GM, 4-brg. set.

SLIPRING MOTORS
3 Phase, 60 Cycle

Qu.	HP	Make	Type	Speed
2	2500	G.E.	MT	253
1	1000	Westg.	CW	450
1	1000	Westg.	HR	360
1	1000	G.E.		400
1	850	Allis. Chal.		1180
1	800	Westg.	CW	360
2	800	Westg.	CW	507
1	800	Westg.	CW	900
1	750	Allis. Ch.		440
1	750	G.E.	I-P	900
	700	G.E.	MT-10	710
1	600	Westg.	with drive	350
1	600	Westg.	CW	390
1	500	G.E.	MT412	435
1	500	G.E.	MT412	450
1	450	G.E.	MT412	600
1	400	Westg.	CW	435
1	400	Allis Chal.		600
1	400	G.E.	I-M	720
1	400	G.E.		1200
1	400	G.E.	IP	1800
1	350	Allis Cha.		300
1	350	G.E.	MT	300
1	350	G.E.	I-M	900
1	300	G.E.	I-24	293
1	300	Westg.	CW	400
1	300	G.E.	I-P	450
1	300	G.E.	MT-410	450
1	300	Westg.	CW	500
1	300	G.E.	I	514
1	300	G.E.		720
1	250	Westg.	CW	435
1	250	Cr. Wheeler	SR27QB	600
1	250	G.E.	IM	435

SQUIRREL CAGE MOTORS
3 Phase, 60 Cycle

Qu.	HP	Make	Type	Speed
1	1000	G.E. 2200 v.	K	509
1	700	G.E. 2200 dr.p-proof cons.	KF	1800
1	600	Fair. Morse	H2	212
1	500	G.E.	IK	1200
1	500	Westg.	CS	1750
1	400	Allis Chal.		600
1	400	G.E.	I-M	950
1	400	G.E.	I-K	1800
3	250	Westg.	CS	350
1	250	Ideal	A	1200
4	250	Fair. Morse	BB	1800
1	225	G.E.	I-E	1800
1	225	G.E.	FT	3600
1	200	Allis Chal.	AN	347
1	200	Fair. Morse		514
1	200	Westg.	CS	600
1	200	G.E.	IK	600
1	200	G.E.	KT566	720
3	200	G.E. 2200 v		1800
3	200	Fair. Morse	BB	1800
1	200	Westg.	CS	3600
2	200	G.E.	KTP	3600
1	150	Allis Chal.		570
1	150	G.E.	IK	600
1	150	Westg.	CS	1800
2	120	G.E.		720
2	150	G.E.	I-K	720
1	150	Allis Ch		850
1	150	G.E.	K-558	900
1	150	Westg.	CS	1800
4	125	G.E.	KT	720

TRANSFORMERS

No.	KVA	Make	Type	Prl.	Sec.
2	200	G.E. 3 ph.	Auto. HT	4000Y	2300Y
1	100	G.E. 3 ph.	25 cy. HT	9000	230
1	75	Darling	Auto H.182	10	250
2	75	West.	S	3810	244/122
3	75	West.	SK	3810	244/122
1	30	Kuhlman 3 ph.		210/220/230	55/100
1	15	Ft. W. A.		1050/2100	2200/288
1	10	Moloney	HE	1100/2200	220/440
1	7½	G.E.	H	1100/2200	244/488
1	7½	G.E. 3 ph.	HT	2300/3810	220/440
1	7½	Pitts.	HE	2200	110/220
	7½	G.E. 3 ph.	HT	6600	230
1	6	Sorgel 3 ph.	SO	140	228
1	5	G.E.	H	1100/2200	220/440
1	3	Moloney	HE	2200	110/220
1	3	Moloney	HE	1150	115/230
8	3	G.E.	H	220/440	55/110
1	1½	Al. Ch.		2200	110/220

DIRECT CURRENT MOTORS
230 Volts

Qu.	HP	Make	Type	Speed
2	700	G.E. 600 v.	MPC	160/525
1	300	G.E.	MP-8-300	425
1	250	G.E.	fn. cld.	1250
1	200	G.E. water-proof	MDN110	300/450
2	195	G.E.	intm. 1-hr.	840
1	150	West		750
1	150	Cr. Wh.	CCM	1100
1	150	West	SK	200/400
	142	Continuous 600 v.		785
2	112	West.	SK-144	1750
1	100	West.	intpl	850
1	100	G.E.	BRM	1640
1	100	G.E. shunt intp		1100/1800
1	100/130	G.E.	CO	550/600
1	100	G.E. shunt	CD147	450/1150
1	35/100	G.E.	CD165	425/850
2	90	West. shunt	SK	575/1150
1	75	West	S-12L	700
2	75	G.E.	RC-16	950

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1320 W. CERMAK RD.
CANAL 2900

CHICAGO 8, ILL.

GOOD VALUES—ALWAYS

300 KW Nordberg Diesel Generator.
250 KW Ingersoll Rand Diesel Generator.
200 KVA Fairbanks Morse "V" Diesel Set.
75 KW Superior Diesel Generator Set.
800 KW Rathbun Jones Gas. Eng. Gen.
125 and 225 KVA Worthington Diesels.
75 KVA Fairbanks Morse Oil Engine Set.
2—80 HP 125 lb. Steel Cased HRT Boilers.
1—150 HP same as above. All Good.
20 ton American 100' Boom Guy Derrick.

Water Tube Boilers—Air Compressors
Steel Sheet Piling—Pile Hammers, etc.

Mississippi Valley Equipment Co.

507 Locust St. St. Louis 1, Mo.

Motor Generator Sets—Synchronous Motors, Etc.

M-G SETS

1—West. 500 KW 275 or 600 Volt D.C. 720 RPM, 2300 Volt 80% P.F. 720 HP A.C.

VERTICAL MOTORS

1—G.E. 80 HP 1200 RPM 3 phase 60 cycle 220 Volt
1—Reliance fan-cooled 25 HP 1750 RPM 220/440 Volt

SYNCHRONOUS MOTORS
3 phase, 60 cycle, A.C.

1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 250 HP 600 RPM 440 Volt 3-bearing
1—Ideal 50 HP 600 RPM 2300 Volt

SLIP RING MOTORS, 3 phase, 60 cycle

Allis-Chalmers 250 HP 600 RPM 440 Volt

G.E. 62½ HP 1150 RPM 440/220 Volt

D. C. EQUIPMENT

20—Clark Bulletin 5370 80 HP 230 Volt D.C. automatic starters—none used over two months.

A large number of adjustable speed D.C. motors from 5 to 150 HP

ALTERNATORS SPECIAL, Allis-Chalmers, 125 KVA 277 RPM 3 Phase, 60 cycle

The Electric Motor & Repair Co., Cuyahoga Falls, O.

TURBO-GENERATORS

A FEW OF THE COMPLETE UNITS NOW IN OUR STOCK

1—6250—KVA. G.E. 3/60/2300V. 200#
1—3125—KVA GE 3/60/2300V. 200#
2—1875—KVA GE 3/60/2300V. 200#
1—1000—KW. DC. West. 3/60/250; 135/200#
1—1563—KVA. G.E. Non-Cond.
1—937—KVA GE Automatic Extraction 3/60/2300 V. 200 lbs.
2—937—KVA Allis-Chal. 3/60/2300:200#
1—250—KVA GE. Non-Cond. 3/60/480

Also Any Capacity or Type Desired.

WILMS, WEAVER & COMPANY

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• SPECIALS •

1000 KW. 250 v. steam engine generator set

500 KW. DC generator, 600 v. DC 900 speed, Allis Chalmers. Can assemble motor generator set

120 KW. 250/500 v. DC gasoline engine gen. set

312 KVA. West. synchronous frequency changer, 440 v. 30 cy. input, 440 v. 60 cy. output, 900 rpm.

145 KW. 125 v. Motor Generator Set, Westinghouse type SK 285 HP. syn. drive, 4150 v. or lower

70 KW. Motor Generator Set, 70 v. 1000 Amp. Burke, synchronous drive

150 KW. 250 v. West. SK, MG set, 2300 v. syn. drive.

667 KVA. transformers 23,000 volt primary 440 v. sec. 60 cy. single phase. Three units available.

1250 KVA. Ideal 2300/4000 volt, 60 cycle, 3 phase, 1200 rpm. synchronous generator

35 KW. 125 volt motor generator set. Any AC voltage drive.

Phone us collect, station to station, on your requirements. Tell the telephone operator who is calling and the reason for the call.

ELECTRIC EQUIPMENT CO.

BOX 51 ROCHESTER, N. Y.

PHONE GLENWOOD 6783

2—4000 KVA. 60 Cy. 3 Ph. TURBOS with Surface Condensers

HYDRO ELECTRIC UNITS

1625 KVA. 60 Cy., 250 RPM.
750 KW. 360 RPM. 60' Head.
700 KW. 257 RPM.
1500 HP. Impulse, 150 RPM.
1600 HP. 550' Head.
HEAT EXCHANGER 606 tubes 1¼"x3'6".

1500 CFM 2 STAGE AIR COMP.

275 HP. 60 Cy. 3 Ph. 2200 V. Syn. Motor Dr.

1100 Ton Hot Metal Mixer

24" Back Pressure Valve F&D.
2—20" VALVES—F&D, also Ells & Tees.
3—500 HP. STIRLING BOILERS 200#.

100 KW-550 V. TURBO

3600 Rev. 60 cy 3 ph—with dir. con. exciter
2—CENT. PUMPS 4166 GPM, 162' Head.
1—3600 GPM, 27' Head CENT. PUMPS.
TRAVELING CRANE, 75 ton Case, 64' Span,
750 KW. and 110 KW. AC HYDRO ELEC.
1—M-G SET. Motor 225 HP. 4100 V. 60 Cy. 3 Ph. driving 2-90 V. generators.
500 KW. NON-COND. 60 CY. TURBO.

ROSS POWER EQUIPMENT CO., Indianapolis, Ind.

COMPLETE TURBO GENERATOR PLANT

Practically New. In Operation 18 Months Only.

1—Murray Standard Turbine 300 H.P., 150 lb. steam pressure, 2 lb. back pressure, 4 stage, 3600 RPM—includes separator and trap, 4-inch tracifier and 2-inch steam trap.

1—Allis Chalmers A.C. Generator, 200 KW, 240 volt, 603 amps., 60 cycle, 3-phase 3600 RPM.
Excitation, 125 volts, 42 amps., continuous full load.

Exciter, direct connected to generator. 125 volt full load 52 amp., 3600 RPM.

1—Switchboard Complete with voltmeter and ammeter for exciter and generator, oil switch, rheostat, exciter switch, electric meter, steam-flow meter, and latest Allis-Chalmers rocking contact voltage regulator.

PIONEER LAUNDRY AND DRY CLEANING CO.

1291 Sixty-Third Street **Oakland 8, Calif.**

FOR SALE

1—500 KW 2/60/240 volt, 3600 RPM non-condensing Westinghouse Turbine and switchboard, 140# steam pressure.

1—500 KW Allis-Chalmers mixed pressure 3/60/480 volt 3600 RPM condensing turbo generator, direct connected exciter and switchboard.

1—300 KVA Bullock Alis-Chalmers 3/60/480 volt, 120 RPM Generator with belted exciter and switchboard. Direct connected to:
Filer & Stowell right hand full Corliss Engine 22" x 42", with 15' flywheel, 20" face.

1—375 KVA Allis-Chalmers 2/60/240 Volt, 150 RPM Generator, direct connected to 400 HP Ridgeway left hand steam engine. 19" x 28" with belted exciter.

RALPH H. ROGERS & CO.

306 Millsaps Building, Capitol and Roach Sts.
JACKSON, MISSISSIPPI

FOR SALE

Electric Revolvator Stacker

1500# Capacity—Overall height 16'—Steel platform size 36" x 38". Platform speed in both directions 20 FPM, equipped with high torque reversing type motor—2 HP, 220V—Single Phase. Also Beaumont Skip Hoist.—Drum carries 21 strands ⅝" wire rope—200' of rope available. Motor to operate hoist direct connected DC—110 V —7½ HP—700 RPM.

EMPIRE BOX CORPORATION
GARFIELD, NEW JERSEY

DIESEL ENGINES FOR SALE

1—200 H.P. Cooper-Bessemer Full Diesel Solid Injection, 6 Cyl., 4 Cy., 326 RPM., bore 11" x 14" stroke.
2—55 H.P. Fairbanks-Morse Model 32D, Y.V.A., 1 Cyl., 360 RPM, clutch and outboard bearings.

ALJON ELECTRIC DIESEL CO.
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COMPRESSORS

Over 150 in stock

New and Guaranteed Rebuilt
Modern Plant doing Modern Rebuilding
From 50 CFM to 2500 CFM

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METROPOLITAN PLUMBING SUPPLY CO., INC.

Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquids and Chemicals.
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Large Complete Stocks ⅛" to 24"
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1—25,000 & 50,000 Gallon Tanks & Towers
1—85 HP 100# P. Locomotive Type Boiler
1—150 HP ASME Erie City Economic Boiler
1—175 HP ASME Locomotive Type Boiler
1—400 KVA 480 V. Gen. D/C 4-Val. N.R.C.
1—120 KVA 240 V. Gen. D/C 4-Val. N.R.C.
1—50 KVA 3 Ph. Gen. D/C Steam Engine
1—750, 150, 120, 100 & 90 HP Full Diesels

H. & P. MACHINERY CO., 6719 Etzel, St. Louis

APPLICATION ENGINEERS

List equipment you want to sell with us. Our available equipment list includes a complete diesel plant consisting of three 150 HP—240 volt units and many other items.

Send us specifications of your needs.

HOWARD BLAINE JOHNSON & ASSOCIATES
53 W. Jackson Blvd., Chicago 4, Illinois.

ELECTRICAL EQUIPMENT — PROMPT SHIPMENT

SLIP RING MOTORS—3 ph., 60 cy.

HP	Make	Volts	RPM	Type
1600	Westgh.	2200	435	CW
500	G.E.	2200	435	MT412
300	Westgh.	2200	495	CW
200	G.E.	2200	495	IM
200	G.E.	2200	240	MT412
2–150/75	Westgh.	2200	590/295	CW
150	Westgh.	2200	375	CW
150	Westgh.	2200	590	CW
125	Al Chal.	2200	435	ANY
100	Al. Chal.	220/440	575	ANY
100	Westgh.	2200	490	CW
75	Westgh.	2200	290	CW
50	G.E.	220/440	865	MT342
50/12.5	G.E.	2200	865/435	IM
37	Otis	220/440	1140	Int.
5– 30	Westgh.	220/440	865	CW
30	F. M.	220/440	1150	Ball Brg.

Also many smaller motors in stock

SLIPRING—3 ph., 25 cy.

HP	Make	Volts	RPM	Type
100	G.E.	220/440	500	MI108

SYNCHRONOUS MOTORS—3 ph 60 cy

HP	Make	Volts	RPM	Type
200	Westgh.	2200	900	.8 P.F.
150	G.E.	2200	900	ATI-.8 P. F.

SQUIRREL CAGE—3 ph., 60 cy.

HP	Make	Volts	RPM	Type
1000	G.E.	2200	514	KT
100	G.E.	220/440	1150	I-K
75	Westgh.	220/440	860	CS
2–50	Triumph	220/440	685	B
50	G.E.	220/440	690	AN
40	Al. Chal.	220/440	1150	AN
30	Al. Chal.	220/440	1150	AN
30	Al. Chal.	220/440	860	AN
25	F. M.	220/440	1150	B
25/7½	Cro. Whe.	2200	1170/585	119AQ
2–25	Elec. Mchy	220/440	495	
15	Westgh.	220/440	965	CSEL

D. C. MOTORS

HP	Make	Volts	RPM	Type
230	G.E. (Ser.)	500	475	MD109.5
175	Westgh.	250	320	S
175	G.E. (Ser.)	500	475	MD8109¼
140	Westgh. (Ser.)	500	515	MC90
130	G.E. (Ser.)	230	550	CO1812A
100	G.E. (Ser.)	500	650	CO1812
100	G.E.	115	575	DLC
70	G.E.	230	800	CL
55	Westgh.	230	825	S-10
40	Westgh.	230	550/1650	SK-150

TRANSFORMERS—1 ph.

KVA	Make	Pri.	Sec. Volts
3–500	G.E.	25000	2200
3–300	G.E.	25000/11000	110
3– 50	G.E.	2200	220/440
3– 50	G.E.	22000	2200
2– 25	G.E.	2200	244/488
10– 10	Westgh.	2200	122/244
35– 7½	G.E.	2200/1100	122/244
20– 5	Westgh.	2200/1100	122/244

SYN. MOTOR GENERATOR SETS

150 KW G.E. 250 V. 900 RPM cpd. Interpole dir. con. 225 HP G.E. ATI-2300/4000 V. 3 ph. 60 cy. P.F. with swbds.

100 KW Westgh. SK 250 V. 900 RPM dir. con. 150 HP G.E. 2200 V. 3 ph. 60 cy. ATI with swbds.

ARC WELDER M-G Sets

600 amp. Lincoln 220/440/3 ph. 60 cy.
4—300 Amp. Lincoln 220/440 v. 3 ph. 60 cy.
5—400 Amp. Lincoln 220/440 v. 3 ph. 60 cy.

A.C. and D.C. GENERATORS

200 KVA . 8 P.F. 180 KW 2400 V. 3 ph. 60 cy. 720 RPM G.E.
150 KW 250 V. 450 RPM Westgh. "S"
100 KW 250 V. 600 RPM G.E.
2—100 KW 250 V. 900 RPM Westgh. "SK"
75 KW 125 V. 700 RPM G.E. "DLC"

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1—#55 Raymond Impact Pulverizer direct connected to Westinghouse Motor, 60 HP, 3 ph., 60 cy., 440 V., 1800 RPM

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1—624 HP Edgemoor Boiler, 200# pressure, underfeed stoker.
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1000 KVA Diesel Generator Plant complete.
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2—150 KVA 2400/4160Y to 480/240 V G.E. type H, form KS, Serial Nos. over 5 million
3—100 KVA 2400/4160Y to 480/240 V G.E. type H, form KS, Serial Nos. over 5 million
3—20 KVA 2400/4160Y to 480/240 V G.E. type H, form KS, Serial Nos. over 5 million.
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All alike in principle— to assure you the utmost in heating capacity and oxygen removal

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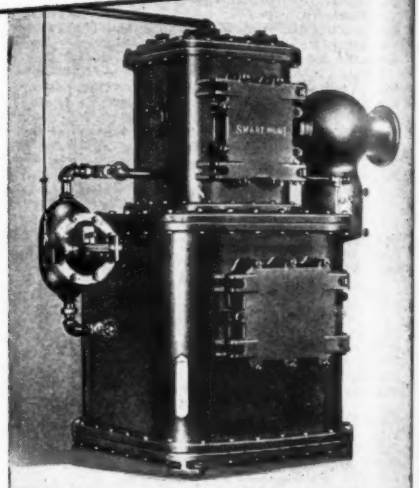
that bear the name

★ Swartwout ★



EACH HEATER pictured here was engineered to meet somebody's need; it might be *yours,* with a little more or less heating capacity or storage space, or tailored to meet space limitations. The method of heating and deaerating in all of them is Swartwout's, guaranteed to produce the results required. The proved ability of Swartwout Heaters to remove oxygen and mineral solids from feed water means less outage—lower maintenance and expense. Their rugged construction . . . backed by Swartwout's high standards of engineering, workmanship and materials . . . means life-time trouble-free performance.

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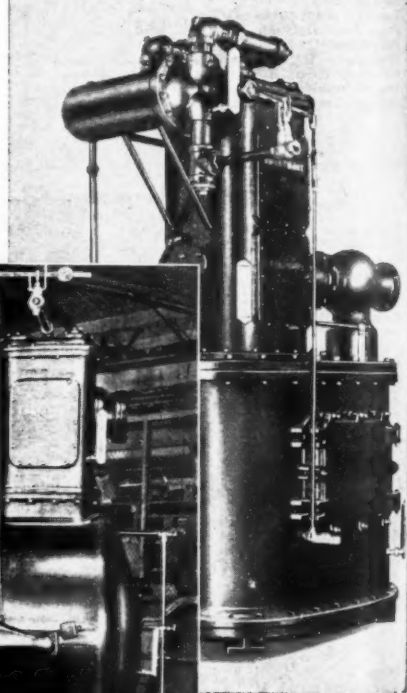
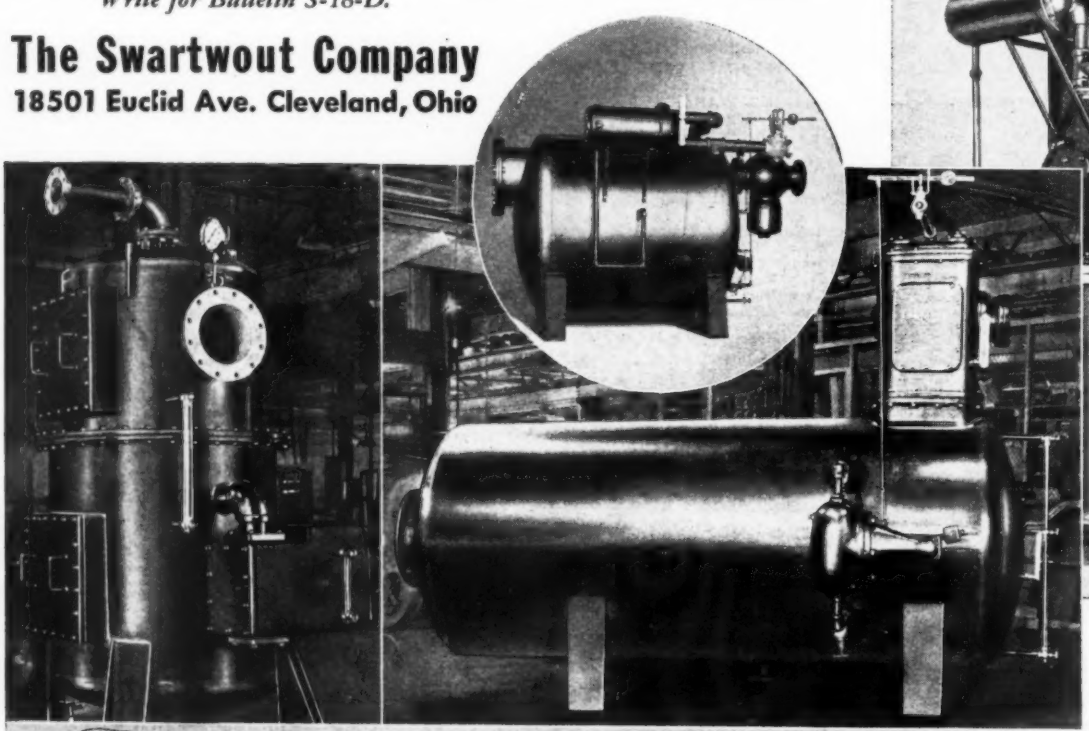
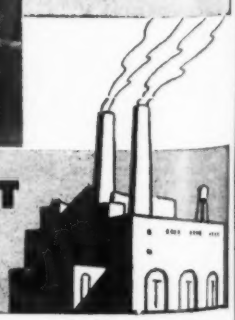


The Swartwout Company
18501 Euclid Ave. Cleveland, Ohio



Swartwout POWER PLANT EQUIPMENT



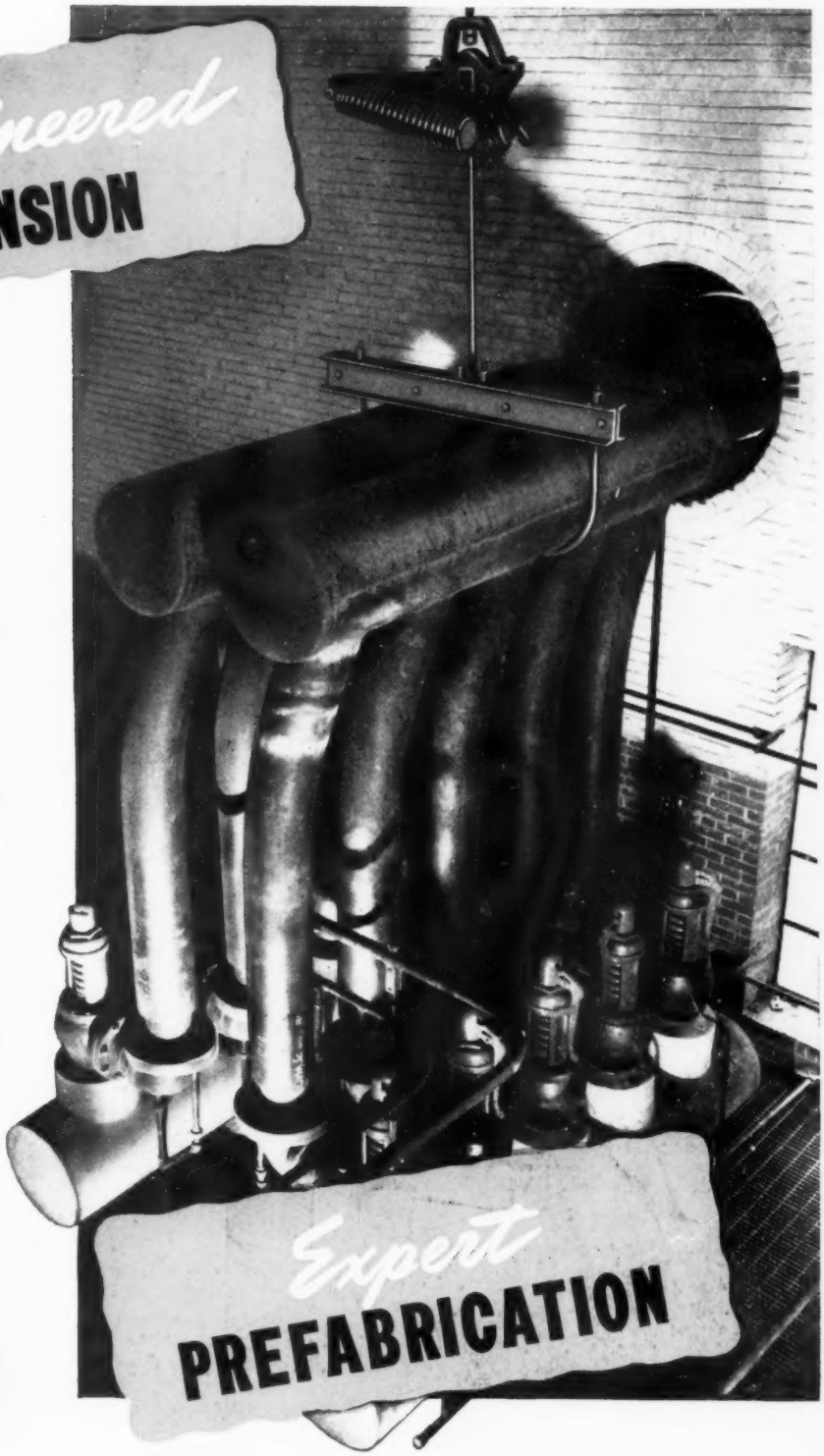
Pre-Engineered SUSPENSION

GRINNELL CONSTANT-SUPPORT HANGERS

The only hanger offering all these important features for high temperature piping support. Constant support of piping in all "hot" and "cold" positions – full safety factor of the supported system is always maintained • Mass produced from standard precision parts • Individually calibrated for each specific installation • Rated capacity of each model varies with the size of the springs used – overall dimensions of the hanger remain constant • Minimum headroom required.

GRINNELL PRE-ENGINEERED SPRING HANGERS

Save engineering time required when hangers are "tailor-made" for each load condition. 14 sizes with a load range from 84 lbs. to 4700 lbs. Minimize changes in pipe supporting force • All-steel welded construction meets pressure piping codes • Unique swivel coupling provides adjustment and eliminates turnbuckle • Compact – require minimum headroom • Installation simplified by integral load scale and travel indicator • Easy selection of proper sizes from Capacity Table.



Expert PREFABRICATION

Grinnell also offers expert engineering and prefabrication of pre-tested piping sub-assemblies like this safety valve discharge piping in a power station. Conveniently located Grinnell plants reduce time-consuming field erection. Consult Grinnell Engineers for assistance on any piping installation.

GRINNELL COMPANY, INC.

Executive Offices, Providence 1, R. I. Branch offices in principal cities

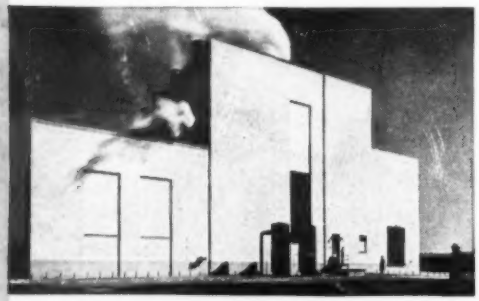
GRINNELL

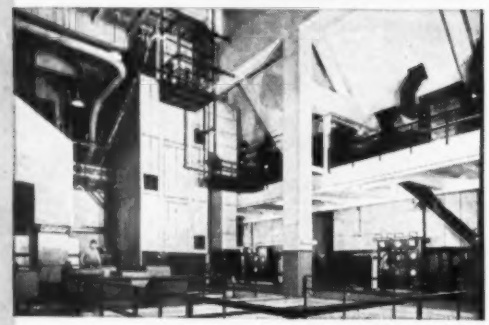
WHENEVER **PIPING** IS INVOLVED

MORE POWER BUILDS MORE AIRCRAFT ENGINES . . . FASTER

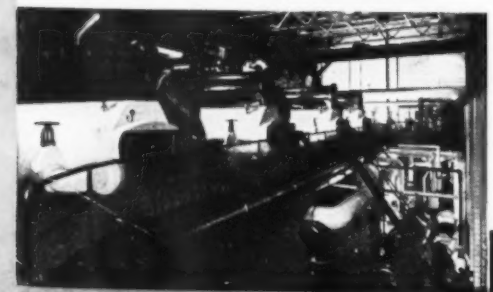
POWER PLANTS of *Wright Aeronautical Corporation* EQUIPPED WITH

No. 1 and No. 2 Power Plants at Wright Aeronautical Corporation, Lockland (Cincinnati), Ohio. Albert Kahn Associated Architects and Engineers, Inc., Detroit, Mich. Insulations applied by Robert A. Keasbey Co., New York.





The No. 1 Boiler House contains four huge boilers, fired by pulverized coal. Carey Insulations used.



Carey Magnesia-Asbestos HEAT INSULATIONS

Two big power plants supply the giant Wright Aeronautical Corporation at Lockland (Cincinnati), Ohio—one of the nation's largest war industries manufacturing aircraft engines.

Both plants are equipped throughout with dependable CAREY HEAT INSULATIONS assuring maximum power production from minimum fuel in this vast project, just as they do in hundreds of other war plants, civilian industries, and utility power plants the nation over.

Through years of scientific research and testing, Carey 85% Magnesia and Hi-Temp Heat Insulations have been carried to their present state of high efficiency and durability. And continued research assures rigid maintenance of the quality standard.
For full details, write Dept. 16.

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